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MARYLAND
STATE BOARD OF HEALTH,
1891.

SPECIAL REPORT

ON THE

Prevalence of Typhoid or Entero-Miasmatic Fever

AT

CUMBERLAND, MD.

BY

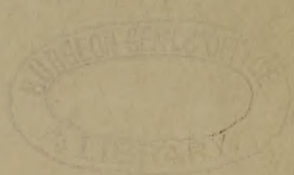
C. W. CHANCELLOR, M. D.,

SECRETARY AND EXECUTIVE OFFICER.

May 17th, 1891.

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REPORT ON THE PREVALENCE OF TYPHOID OR ENTERO-
MIASMATIC FEVER IN CUMBERLAND, MD., BY C. W.
CHANCELLOR, M. D., SECRETARY OF THE STATE BOARD
OF HEALTH.

TO HIS EXCELLENCY THE GOVERNOR OF MARYLAND:

On the 6th day of February, 1891, the following letter
was addressed to me as the Executive Officer of the
State Board of Health:

"CUMBERLAND, MD., February 6th.

"TO DR. C. W. CHANCELLOR,

"Secretary State Board of Health :

"The undersigned citizens of Cumberland would respectfully
request that the State Board of Health make a thorough sanitary
and scientific inquiry into the cause and progress of the fever
which has prevailed in this city at intervals for the past twelve
months, and take such steps and do such things as may be deemed
advisable to arrest and permanently free the town from the said
disease, which, it is believed, is dependent entirely on local causes
that can be ascertained and overcome. * * * ."

"(Signed)

W. M. MCKAIG (<i>Mayor</i>),	D. J. BLACKISTON,
DAVID B. SLOAN (<i>States At-</i>	D. ANNAN,
<i>torney</i>),	H. VIRGIL PORTER, JR.,
JAMES P. GAFFNEY (<i>City En-</i>	R. CLEARY,
<i>gineer</i>),	HENRY JANDORF,
M. A. R. F. CARR, M. D.,	D. C. MILLER,
THOMAS M. HEALEY, M. D.,	R. D. JOHNSON,
C. H. OHR, M. D.,	ROBERT McDONALD,
LLOYD LOWNDES,	JAMES CLARK,
I. SMITH JOHNSON,	BENJAMIN A. RICHMOND,
THEO. LUMAN,	A. HUNTER BOYD."
ROBERT R. HENDERSON,	

Your Excellency having approved this proposal, I thereupon received my instructions from the State Board of Health, and commenced the inquiry on Monday, the 23rd of February, 1891, with the following assistants: Professor William P. Tonry, Ph. D., Chemist; C. O. Miller, M. D., Bacteriologist; R. C. Massenberg, M. D.; Henry S. Jarrett, M. D.; L. Caskin, M. D.; William S. Tonry; and G. R. Godman, Inspectors.

From the nature of the inquiry it was necessary to make a house-to-house inspection in systematic order, and to visit various kinds of business establishments, especially such as produce effluvium nuisances. The magnitude and difficulties of the inquiry were obvious as soon as it was fairly entered upon, and a considerable number of houses were necessarily passed over, but I think it will be found that the most important parts of the city have been investigated.

The investigation, though instituted in regard to the cause and prevalence of the disease, was also concerned in part with the general sanitary circumstances of the place. In this connection I must express my obligations to Mr. James P. Gaffney, City Engineer, for valuable assistance in various ways. I am also indebted to Drs. Carr and Healey for much information as to the incidence and spread of the prevailing disease, and to Mayor McKaig for co-operation in distributing notices to abate nuisances, and for supplementing the same with a circular note in each case urging prompt compliance with the orders of the State Board of Health.

BEGINNING THE WORK OF INSPECTION.

As preliminary to the inspection the following circular under date of February 20th, 1891, was distributed by being left at each house in the city:

“TO THE CITIZENS OF CUMBERLAND:

“The prevalence at this time of a fatal form of fever which has existed in your city at intervals for more than twelve months, has

induced a number of prominent physicians and citizens to call upon the State Board of Health to adopt such measures and do such things as may seem proper and necessary to improve the sanitary condition of the place.

"Acting under the provisions of Article XLIII, Section 3, of the Code of Public General Laws, the Board, with the approval of His Excellency the Governor of the State, has accordingly directed me 'forthwith to cause all needful sanitary measures and precautions to be taken which the emergency may call for, and which may be consistent with law,' in order to abate existing sanitary evils and restore the salubrity of the community.

"To this end you are hereby notified that a force of inspectors will be at once applied to the work of making a careful investigation of the insanitary condition of every street, alley, house and premises. It is earnestly hoped that the citizens generally will aid and facilitate the inspectors in obtaining an accurate knowledge of the defects and evils which is the first step toward their remedy, and thus co-operate with the Health authorities in the effort to limit the progress of disease and death.

"Your attention is especially called to the necessity of promptly abating all nuisances existing on your premises, such as filthy privies, vaults, cesspools, slop-holes, pig-pens, stables, slaughter-houses, and wet, mouldy cellars or basements. Such sanitary work by individual owners or occupants of property having been accomplished, it will only remain for the authorities to determine what further action, if any, is necessary.

"In the absence of sewers, the best that can be done will be to construct surface or tile drains for liquid matters to the nearest natural drainage, as by a ravine or water course, which should be kept free from solid filth, garbage, &c. Such matters should be properly taken care of by individual householders, and removed at short intervals by the city.

"Duty to the community demands that every owner, agent or occupant of property shall see to it that his or her premises and surroundings are placed and kept in the best attainable sanitary condition, otherwise formal notice will be served on delinquents and the penalties of the law enforced.

"C. W. CHANCELLOR, M. D.,

"Secretary and Executive Officer,

"State Board of Health."

BLANKS FOR HOUSE-TO-HOUSE INSPECTION.

The necessary blanks for house-to-house inspection were printed and bound in books with flexible backs,

each containing fifty sheets. These measured six by nine inches, and are as follows:

No. —. STATE BOARD OF HEALTH. 1891.

1. Ward —; street —; No. —.
2. Owner or occupant —.
3. Area of lot —; of house —; out-houses —.
4. Age of house —; material —; number stories —.
5. Cellar and basement —.
6. Rooms and passages —.
7. Sinks, drains, and cesspools —.
8. Privies or water closets, location and condition —.
9. Yards, condition —.
10. Hogs —; horses —; cows —; fowls —.
11. Public nuisances on or near premises —.
12. Number families in house —; names of heads of families —; number of persons in each —; white —; colored —.
13. Sickness now in house —; what disease —.
14. Any sickness during past year —; what disease —; number cases —.
15. Deaths during past year —; what disease —.
16. Water supply —; sources of contamination —.
17. Milk supply —.
18. Sanitary needs —.

The above is correct as personally examined by me this — of —, 1891.

Inspector.

In the front of each book specific directions for filling blanks were printed, and the inspector requested to refer frequently to the instructions.

The following notice was served during the progress of the inspection to each occupant or owner of premises on which nuisances were found to exist:

EXECUTIVE OFFICE,
STATE BOARD OF HEALTH,
CUMBERLAND, — —, 1891.

To — —:

In compliance with an order of the State Board of Health, approved by His Excellency the Governor of the State, directing a careful and thorough sanitary inspection of the town of Cumber-

land, I have so far made the required investigation as to find that a nuisance, consisting of — —, exists on your premises, and you are hereby notified to abate the said nuisance and place your premises in good sanitary condition without delay. A failure to comply with this notice within — days from its date will render you liable to prosecution under the Sanitary Laws of the State.

C. W. CHANCELLOR, M. D.,

Secretary and Executive Officer.

After a general survey of the city and obtaining information from the authorities and principal citizens of the place, and after an examination of the results of so much of the house-to-house inspection as was completed on the 11th of March, I presented a preliminary report addressed to Mayor McKaig, of which the following is a copy:

PRELIMINARY REPORT OF THE SANITARY CONDITION OF
CUMBERLAND, MD.

STATE BOARD OF HEALTH,

SECRETARY'S OFFICE,

CUMBERLAND, March 11, 1891.

To Hon. Wm. M. McKaig, Mayor.

DEAR SIR:—In view of the great desirability of taking immediate precautions to improve the sanitary condition of Cumberland, I would respectfully offer the following suggestions as preliminary to my official report, which may not be published for some months to come, premising that I do this with a full appreciation of the difficulties and drawbacks under which the city has heretofore labored, and must continue to labor unless a strong code of health laws is enacted by the municipal government.

After a partial survey of the city, and an examination of the results of so much of the house-to-house inspection as has been already completed, I have, in view of the urgency of the case, decided to furnish you this preliminary report, together with such recommendations as are deemed important to be adopted at once for the better sanitary government of the city.

The inquiry was instituted, as you are aware, at the request of a number of prominent citizens and physicians, to ascertain, if possible, the cause of the unusual sickness which has prevailed at intervals in this city, with more or less fatality, since the middle of December, 1889. The inquiry is also concerned in part with the general sanitary circumstances of the place, but it has been con-

ducted with special reference to the incidence of the prevailing disease.

That the existence of this disease is in some way associated with certain unsanitary conditions, as cause and effect, cannot be doubted, but it is quite impossible to make public, at this time, all the facts upon which a final conclusion will be based, as the data have not yet been fully collated and studied. This much may be premised, however, that in respect of particular cases there are conditions or circumstances existent which might suffice to explain the occurrence of the disease independently of any peculiar water supply—conditions which can be readily corrected. The entire absence of a uniform method of sewage disposal makes Cumberland essentially a city of cesspits and cesspools. These are usually situated in back yards, or gardens, and sometimes in close proximity to or under dwellings. Besides these disease engendering reservoirs, there are in various parts of the city old drains nominally for carrying off storm water, but which in some instances receive in addition excremental matters from the houses near or beneath which they pass. Surface channels exist in most streets for carrying off storm and slop waters, all of which are finally discharged into one or another of the several water-ways which pass through the city.

The conveniences which exist for the deposit and final disposal of excremental matters are very limited and exceedingly primitive, and so varied as to defy all attempts at a definite classification. In a majority of cases the arrangements consist of privies with or without pits. In many such privies, the excrements being under cover, yet exposed to the winds, are soon desiccated and become the sport of every passing breeze. The system, if it may be so termed, of removal is a sort of "do as you please" method, and the stuff is removed or not as suits the convenience or fancy of the owner or occupant. Again, the privy pits are for the most part dug in the ground, without being cemented on sides or bottom, so that the liquified contents are constantly soaking into the soil, and in many instances pass through the foundation walls of houses into the cellars. In comparatively few houses the water closet system is in operation, the soil pipe discharging on an open surface, or into a drain having its outlet in the river, creek or race. In a few instances there are absolutely no special conveniences, the male members of the family resorting to a shed or any convenient place, the females using chamber vessels, which are emptied into one of the natural drains of the town, or on to a pile of rubbish or manure in the garden or stable yard.

It is stated that water-closets have of late years replaced a number of the old privies. However this may be, it is certain that

cesspit privies, and privies discharging directly into the creek or race still exist in large number. In the absence of any proper system for the disposal of excretal sewage, it may be questioned whether replacement of cesspit privies by cesspool water-closets be, in a sanitary sense, improvement. Such replacement generally results in a multiplication of an increase of size of such receptacles, and of storing, therefore, a greater amount of matters dangerous to health, for here, as elsewhere, the frequent emptying of water-closet cesspools would prove a costly process. And in regard to non-water-tight cesspools, they facilitate soakage of the contents into the soil, and thence to wells and water supplies. Moreover, it is in many instances substituting for an out-door privy, with but small capacity for mischief, an in-door water-closet more dangerous because destitute of proper provision against admission of cesspool air into the dwelling.

In regard to the disposal of other solid refuse, such as ashes, garbage, &c., these matters are generally piled up in the back yard, or dumped into any convenient alley. There is no system of removal, and when allowed to accumulate such matters have to be removed at the expense of the owner or occupant of the house at quadruple the expense it would cost to remove them by a well-organized system under the control and direction of the city. Night soil is only removed by arrangement of the occupiers or owners of property, and often accumulates to the extent of creating an insufferable nuisance. As to slop refuse, it is cast into back yards, privy pits, surface channels, streets or alleys, or directly into one of the water-ways traversing the city. There is no system of house drainage, and many cellars are constantly filled with water; indeed, a dry cellar in Cumberland may be said to be exceptional. Many of them are without proper ventilation, dark, damp and mouldy, and not a few contain putrefying organic matter and all manner of debris that emit unhealthy emanations.

There are two natural drains traversing the city from northwest to southeast—"Will's Creek" and "The Race;" the former empties into the Potomac river above the dam opposite the city, and the latter passes into what is known as the canal basin. These two streams, that should constitute a feature of health and beauty in the city, have been converted into elongated cesspools into which is cast, day by day, the most obnoxious filth. It is entirely practicable to follow the movement of the refuse matters thrown into these streams, consisting of dead animals of all kinds, the blood and offal, including entrails from several slaughter-shops, and of a large amount of fæcal matter and household wastes. It is no exaggeration to say that they carry at all times much float-

ing nastiness, part of which is necessarily deposited on the banks and bottom before reaching the river or canal. It has been stated by a number of citizens that at times during the summer much disengagement of fetid gas from the waters of these two streams, in their respective courses through the most populous parts of the city is observed, particularly when the water is very low, and the mud on the bottom is exposed to the heat of the sun's rays.

It is not necessary to say much in demonstration of the nuisance arising from the keeping of pigs, a great many of which are to be found in Cumberland, not only confined in pens, but running at large on the streets. Pig-keeping is a notorious nuisance and should not be permitted in any city, town or village. Still, as a matter of fact and daily observation, pigs are habitually kept in the middle of populous towns, in a most uncleanly and unwholesome manner, and the outcry against their being so kept in a city the size and importance of Cumberland should be persistent and deafening, until the evil is driven from the city by public sentiment, if not by public statutes.

The trade of "fellmonger" consists in receiving the skins of sheep and the hides of other animals, and in preparing them for the use of the leather dresser. Such establishments, of which at least three exist in Cumberland, are usually a source of nuisance to the immediate neighborhood, especially to persons residing in houses adjoining or opposite. Serious complaints are made of the effluvia arising from the establishments located on Centre street, and certainly the trade has been carried on in the roughest manner and with the least regard to tidiness and cleanliness. This is entirely the fault of the persons who carry on the trade, and unless it is corrected at once these establishments should be removed beyond the limits of the city.

The effluvium nuisances arising in connection with slaughtering animals are usually confined to the immediate neighborhood. They may depend: 1. On the uncleanly manner in which animals are kept prior to being slaughtered. 2. On the uncleanly condition of the slaughter-house, or an uncleanly mode of conducting the several processes of slaughtering. 3. On the retention and accumulation upon the premises of hides, skins, blood, fat, offal, dung and garbage, which undergo decomposition and become offensive. 4. On the uncleanly condition of receptacles either kept in the slaughter-house or in the yard, &c. The utmost care is necessary to prevent a slaughter-house, in a populous neighborhood, becoming a nuisance.

It is gratifying to note that a second visit paid to several of these establishments, after notice was served, showed a manifest improvement in their condition, and the proprietors evinced every

disposition to maintain them in proper sanitary condition. This was especially noticeable in the slaughter-house and premises of Mr. Blaul.

In regard to premises generally, a few of the chief facts reported by the several inspectors will be as much as can be cited in this preliminary report. They are as follows: "Unwholesome condition as regards dwelling—water supply suspicious—excrement disposal and drainage of premises need attention." "Privy accommodation insufficient—water supply greatly exposed to pollution—sanitary state of premises generally bad." "Cesspool and well in close proximity and no doubt intermingling through the soil—sink and slop drain in connection with cesspool—excremental fouling of air, earth and water." "Dirty water in cellar from race, the banks of which are constantly fouled by human excrements." "Absence of proper means of sewerage and drainage." "General nuisance from accumulation of manure and an offensive cesspool in the yard." "Water-closet trap found choked and filthy owing to absence of proper means of flushing." "Pigpen in filthy condition, with escape of foul air into the surrounding dwellings." "Public school-house on ——— street badly ventilated, privy arrangements defective and very filthy—more than 50 per cent. of pupils not vaccinated."

The above will serve to indicate the general character of the nuisances reported. I could continue the list of such nuisances existing on nearly 1,000 premises, but enough has been given to show the general character of the sanitary evils existing in the city. A more detailed account will be furnished in the forthcoming official report of the State Board of Health.

To overcome the existence and future recurrence of these great evils it will be necessary for the city to establish a thorough sanitary code, and live up to it. The draft of such a code is herewith presented, and its adoption may be regarded as the first step towards improved sanitation, and is among the most important duties of a municipal government.

I would especially call attention to the necessity of maintaining a Board of Health organized upon an active working basis, and under whose authority vigorous measures of prevention may be pursued. Such measures should never be left to irresponsible individual application. The necessity of creating and maintaining such a Board of Health in every city and town is often too lightly regarded by the public. At a time when general health prevails in a community the thoughts of men are not commonly turned towards preparation for disease. "Sufficient unto the day is the evil thereof" is a doctrine which, however wise it may be in some of the affairs of life, has often been productive of the most lament-

able consequences. When the enemy is at the gate there is little time for measures of defence; when epidemic disease appears, snatching our loved ones from the family circle and spreading dismay over hearts unused to fear—such a time is inauspicious for preparation to meet and vanquish the fell destroyer. Better far to maintain a proper organization at all times, and remove in anticipation the causes, more or less prevalent in every community, which invite disease, than wait until the Angel of Death is already on the threshold.

To this end the City Board of Health should have as its executive an efficient health officer, who should be a well-educated physician, interested in sanitary matters and well informed in sanitary methods. There is work enough in any community to occupy a wide-awake and appreciative health officer for a considerable portion of his time. The great mass of the public are negligent of sanitary concerns. Filth accumulations in public and private places, privies and cesspools become foul and offensive, drains choked up, leaky or otherwise defective, wells and water-supplies are thoughtlessly located so as to receive by percolation or direct flow the contents of privy-pits and vaults, the soil itself becomes polluted by steady and uninterrupted accessions from these and other sources, and in turn pollutes the air, which rises therefrom into the dwellings of the people—all these are recognized causes of disease, and constitute subjects to which the attention of a health officer may be profitably directed.

That epidemics may be averted by the adoption and enforcement of timely and judicious measures of prevention, it would not be difficult to demonstrate. Their germs cannot live and bear fruit in an inhospitable soil. As wheat perishes from drought, so the living principle by which epidemic disease is propagated often dies out when deprived of the nourishment afforded by insanitary conditions. But the latter are essentially under the control of human agency. A single case of small-pox introduced into a community, if left to itself, will multiply indefinitely among the unprotected; but the timely application of vaccination will confine it to its original limits—strangle it in the home of its birth. The same may be assumed of other diseases, as scarlet fever and diphtheria, which are readily stamped out by cleanliness, isolation and disinfection.

In thus presenting the subject to the consideration of the municipal authorities and the people of Cumberland, I am actuated only by a desire to awaken such an interest in the sanitation of the city as may lead to practical benefit, and to enlist the co-operation of the authorities in what is believed to be one of the most important duties imposed upon them in their official capacity.

In promoting an object so essential to the general welfare, the State Board of Health will at all times hold itself in readiness to render any assistance in its power.

Very respectfully,

C. W. CHANCELLOR, M. D.,

Secretary and Executive Officer.

This report was accompanied by the draft of an ordinance, entitled “*An ordinance to more effectually promote the health, comfort and prosperity of the City of Cumberland,*” which His Honor the Mayor was requested to bring to the attention of the City Council, and ask that it be passed, with such amendments as might be deemed proper, in order to secure the object set forth in the title.*

LOCATION, AREA, POPULATION, &c.

Cumberland is situated in an alluvial valley among the foot hills of the Alleghanies, at the confluence of Wills' Creek with the North Branch of the Potomac River, in latitude $39^{\circ} 39'$, longitude $78^{\circ} 45'$. The city limits embrace two square miles of territory, equal to 1280 acres, with a population (census 1890) of 12,729 persons, living in about 2500 houses, many of which are very small and indifferent. A few houses extend up the rising ground formed by the hills on the northern and eastern slopes of the valley. The mean summer temperature for the past 20 years has been 70° Fahr. Mean winter temperature 30° F. Mean annual temperature 52° F. The average rain fall for the same period has been 32 inches; but that of 1889 was 40.17, and for 1890, it was 53.47 inches.

*Since the above was written it is stated that the ordinance above referred to has been rejected by the City Council, and no measures have been adopted to carry out the suggestions contained in the report.

GEOLOGICAL FORMATION AND TOPOGRAPHY.

The median white sandstone, the Clinton shale and Fossil ore, the water-lime, and Niagara limestone and Orriskaney sandstone all have their outcrop in the western portion of the city, west of Wills' Creek. The city on the eastern side is surrounded by high hills composed of Hamilton shales and sandstones, while underlying the central, or level portion of the city, at various depths, the Marcellus shales are found. Wills mountain immediately north of the city, is 1500 feet above mean tide, or 850 feet above the lowest level of the city. Shriver's Hill, east of the city, and partly comprised within its boundary, is 450 feet higher than the river. McKaig's Hill, also on the east side, and partly within the city limits, is 300 feet above the river. The highest point of the city, west of Wills' Creek, is about 150 feet above the river. The central or depressed area of the city is about 640 feet above mean tide, and from 15 to 20 feet above the river.

WATER SUPPLY.

Cumberland is supplied with water mainly from the Potomac River by direct pumping, and also from shallow wells and springs. The water works were built in 1870-1 by the city, enlarged in 1873, and supplied with new pumps in 1880. The daily capacity of the pumps is 2,000,000 gallons, and about that quantity is consumed.* The Baltimore and Ohio Railroad shops and buildings are supplied from works of their own, the water being drawn also from the river; but below the dam which spans the river at a point opposite Cumberland. This dam is the catch basin for a large portion of the filth of

* This indicates an enormous waste of water, occasioned no doubt by leakage from the mains and service pipes, which saturates the soil and keeps the cellars more or less filled with water. Fully two-thirds of the water pumped goes to waste.

Cumberland, carried into it by Wills' Creek and Sulphur Run, which form the two principal drains of the town. In many instances, as will be seen further on, privies are built over these streams, and every sort of filthy and decaying matter, which if used as manure would fertilize the earth, is mercilessly dumped into them, and passes directly into the dam below the intake of the water-supply.

Until within the last year the city water-supply was pumped directly from the river, at a point below Sulphur Run and only a short distance above the entrance of Wills' Creek. It was then ascertained that a number of persons who used the water were subject to affections of the bowels, and in some instances to a low form of fever. Now the water is taken from the river at a point about 900 feet above Sulphur Run, and is, of course, considerably purer than formerly: but the fact should not be lost sight of, that the sewage from towns, villages, farm-yards, stables, slaughter-houses and pig-pens, and the refuse from factories and other decaying rubbish is often turned into the Potomac above Cumberland, without any regard to the well known fact that hundreds of people must drink this water or none at all. It has been stated that pestilential diseases are God's punishment for the wickedness and folly of the people who violate the common laws of health by permitting such a state of things to exist, and it may be that Cumberland has suffered from the "wickedness and folly" of neighbors higher up the river.

But to look "at home." A group of slaughter-houses, tanneries, hide-dressing establishments, stables, pig-pens, privies, and what not, are constantly discharging blood, offal, and refuse of every kind into the Wills' Creek, which empties into the river *above* the dam, and only a few hundred yards below the intake of the present water-supply, consequently in dry weather, when the water does not flow over the dam, it is converted into a semi-stagnant pool or catch basin for all manner of filth. Again, when the river rises to a certain height

above low water mark, it is "backed up," and it is more than probable when this "backing up" occurs the foul matters at the bottom may be carried up to the intake of the water-supply, and from thence distributed throughout the city.

It should be added, however, that this theory as to the pollution of the water-supply, and the consequent increase of the prevailing fever during the winter and spring months, lacks the confirmation of personal observation, which it would require considerable time and great care to make. It is nevertheless obvious, that any considerable rise in Wills' Creek will carry with it the contents of the creek into the dam, and it is not at all improbable that an upward current or eddy would be created by the mingling of the waters of the two streams, which might carry such contents up to, or above the point at which the intake pipe receives the water from the river. Such a condition can only exist when to a suitable stage of water in the Potomac shall be added a down pour of rain, confined principally to the water-shed of the creek heavy enough to swell the volume of water in the creek sufficiently to overcome the fall in the river from the mouth of the intake pipe to the mouth of the creek. Remote as such a coincidence would seem to be, it may nevertheless occur at particular seasons of the year. There is, however, reason for believing, that under certain conditions the surface water of the dam is carried up stream for a considerable distance, even when the deeper water is flowing out. Whether this ever occurs to such an extent as to carry the foul waters of the creek and Sulphur Run up to the entrance of the inlet pipe, I would not presume to assert.

The details of the river water-supply above generalized, will be embraced in special reports by the Chemist and Bacteriologist, herewith transmitted.

A GOOD DRINKING WATER.

A good drinking water should be free from all suspended matters, and as far as possible free from dissolved organic matters. The best water for drinking or dietetic purposes is that which is mingled with pure air, which is free from any organic animal or vegetable matter, either solid or gaseous, and which does not hold in suspension or solution any considerable quantity of mineral matter. Such ideal or chemically pure water is rarely if ever found: but with this as a standard, we can define those departures therefrom which are beyond the bounds of safety.

“Much water,” says Dr. Hunt, “is constantly being used which is contaminated by sewage or other organic impurities. It does not always do appreciable harm, because our systems are so constructed as to adjust themselves to a certain degree of irregularity, and to resist slight or ordinary embarrassments. There is also another reason. Nature, chiefly through the action of the air mingled through or dissolved in the water, is constantly transforming that part of the organic or decayable matter which is carbonaceous into carbonic acid gas, and the harmful nitrogenous matter into insoluble nitre. Both of these, to the degree thus produced, are harmless. It is when this process is interrupted, or when the amount or kind of matter is such as not to admit of sufficient neutralization by these methods, that decomposable matters remain in the water, ready to act as fertilizers for forms of minute life so threatening to the higher life of man. The danger is, that in certain special conditions of atmosphere or temperature or locality, or of our own bodies, this organic matter will be roused into some peculiar or more rapid decomposition, and that some form of disease, breeding animal or plant life will, from it, obtain that abnormal cultivation which will excite disease. This may take the general form of *irritation*, such as will produce

non-specific disease or it may prove *specific* in its character, and we then have cholera, typhoid fever or some other deadly plague.”*

WELLS AND SPRINGS.

As stated in a special report made a few years ago on the water-supply of Cumberland, the wells of the city are for the most part superficial, and the depth of water varies in them considerably during the season.

The natural condition of the soil and sub-soil are such as readily to admit water contamination from surface pollution, both in the wells and flowing springs of the town. The soil being porous, and the water bearing level of fissured limestone or slate, whatever falls upon the surface, or into privy pits or cesspools, percolates the soil until it reaches the hard stratum or fissures of the rock below, and then flows by gravity into wells or springs. In this way the contents of such receptacles, and other filth find ready access into these sources of water supply.

Experience has taught us that water drawn from a soil thus polluted is never safe for drinking or dietetic purposes. The researches of Rodet and Roux (*Comptes Rendus Hebdomadaires des Séances de la Société de Biologie*, February 21st, 1890), have led them to conclude that the typhoid bacillus of Eberth is nothing more than a modification of the bacillus *Coli Communis* in a state of disintegration, and that this bacillus acquires its virulent features outside of the body. It follows, therefore, that water contaminated with fæcal matter, not necessarily typhoidal, or by a soil saturated with such matter, may give rise to typhoid fever, but this view is not generally accepted by bacteriologists.

In 1881, the late Dr. D. P. Welfley, a painstaking physician of Cumberland, furnished the State Board of Health with an interesting paper on the water-supply of

* Principles of Hygiene, p. 37.

the town, containing analyses of *different waters then used*. "Of the seventeen wells and springs examined, three were unconditionally 'condemned,' six were declared 'unwholesome,' and six 'suspicious,' " while only two were represented to be fit for use. More recent investigations have demonstrated very clearly that the pollution has gone on to increase until *there is not now a well or spring in the thickly settled parts of the town free from dangerous contamination*.

The most erroneous ideas in regard to the liabilities of wells to contamination prevail among the people. Those who are familiar with the principles of under-drainage by means of porous tile drains, know that when they are laid horizontally in the earth the water will find its way for quite a long distance on either side of them and through their pores; yet they are only small vent places in the earth of only a few inches in diameter, while a well is a large and deep drain pipe, placed vertically instead of horizontally, and will attract moisture or water into itself from a distance of two, three, or four times its depth; indeed wells have been known to receive contamination from a distance of nearly 1000 feet, and if the well should be sunk down to or in an impervious, inclined, stratum or slope of rock or clay, it may drain localities even further than this. We have only to consider the case of a hillside densely peopled to realize the inevitable pollution of wells and springs from leaking cesspools or drains situated further up the slope.

A report by Mr. Childs, health officer of Oxfordshire, England, contains a striking instance of the fouling of wells from a source above their level, which is reproduced here as forcibly illustrating the danger in question: "In consequence," the report says, "of the escape of the contents of a barrel of petroleum, which had been buried in an orchard, a circuit of wells sixty feet below and three hundred yards distance became so affected that the occupiers of fifteen houses, containing eighty-two inhabitants, were for ten days unable to use the water for

drinking or cooking. The cattle of one of the proprietors, moreover, refused to drink *at the spring* where they were accustomed to drink." Had this soakage been sewage, instead of petroleum, who can doubt that the result might have been wholesale water-poisoning, and an outbreak of typhoid fever, dysentery or cholera. It is a very moderate statement to say that nine out of ten cesspools, or privy vaults, the State over, do leak, and are constructed to leak, and thus save the expense, labor, and nuisance of frequent cleaning.

CISTERN WATER.

Cisterns are liable to the same dangers with wells, and, in addition, usually have carried into them much fine dirt, or pulverized street filth, from roofs which form their water-shed. Even when made with an effective filter-chamber, they should be examined and cleaned every summer, or oftener if their water grows distasteful. Cisterns are also liable to be cracked or burst by pressure from within or without; and, being thus rendered leaky, are occasionally entered by polluted water. From just such a cause there occurred, in the autumn of 1874, an epidemic of typhoid fever in a boarding-school, in Birmingham, New Jersey, and the epidemic of yellow fever in Memphis, Tenn., in the summer of 1878, was undoubtedly augmented, if not occasioned by the same cause. It is interesting to note that the infecting agent in both cases was leakage into the subsoil from privy vaults near the cisterns, both of which were supposed to be strongly built and water-tight. It is all important that cisterns, when used for the storage of drinking water, should be built and maintained with intelligent care, and that their owners should not rest secure in the idea that because they no longer use well water they are in no danger of drinking fouled water. Whatever be the source of supply the price of safety is "eternal vigilance."

Dr. Welfley, in the article before referred to, gives the water analysis of five cisterns in Cumberland, which shows that the water in the best one of them was far from being a good or wholesome water. This was the cistern of a prominent physician, which had been constructed according to the most improved methods; but with all this care it contained too much albuminoid ammonia, and the water was properly classed as "unwholesome." The other four were unequivocally "condemned." In speaking of the large amount of free and albuminoid ammonia, and chlorine in No. 2, Dr. Welfley says:—"On inspection after analysis, four large living frogs, three dead ones, a dead rat, and a deposit of about six inches of black, filthy mud at the bottom, were discovered in it." The amount of chlorine he found would seem to indicate leakage from a household cesspit.

In these receptacles, apart from the danger of sewage pollution, or the intermingling of the contents of the cesspit or cesspool with the water of wells or cisterns, the minute impurities, brought in with the supply, accumulate into a mass of growing foulness which undergoes constant decomposition and being stirred up by the daily delivery, contaminates the entire contents of the cistern or well, and every pint of water which is drawn from it. This consideration, which may be confirmed by volumes of evidence, but is too palpable to require proof, leads to the desirability of dispensing with these separate household supplies of water, by providing a constant supply of pure water in the mains and service pipes of the city supply, so that any required quantity may be at all times instantly commanded.

THE SUPERIORITY OF A PUBLIC WATER-SUPPLY.

The superiority of a public water-supply over private wells and cisterns is not greater in the facility with which the water thus obtained for the current use of the persons supplied than it is in the economy of the supply.

The first cost of cisterns or wells with all the expense and inefficient paraphernalia of pumps, etc., is entirely obviated by keeping the mains, service, and communication pipes always charged. It is well known that the due care and cleansing of cisterns and wells are greatly neglected, especially among the classes who are actively engaged in their business or daily labors, as well as by those who are unable to command the services of others for such purposes. These receptacles are often badly constructed and covered, leaky, open to the entrance of soot, dust, and dirt of all kinds, frequently exposed to the action of the sun, and almost invariably neglected when repairs and cleaning become indispensable. If these separate and inefficient means are superseded by a constant supply of pure water from the public supply, delivered in the best possible condition, the economy will be manifest in many ways, but in none more obviously than an improved condition of the public health.

Impure water means sickness in a community, and sickness means expense, anxiety, and discomfort. Dr. Brouardel, the distinguished hygienist of Paris, has asserted that fully 90 per cent. of all cases of typhoid fever arise from drinking or using for dietetic purposes unwholesome or polluted water. How shall we estimate the cost of sickness caused by bad water and impure air?

It is estimated that there have been in Cumberland during the last 12 months fully 600 cases of fever. Each of which has cost for nursing, medicine, food and other things incident to sickness at least \$45.....		\$27,000
These 600 persons must have had medical advice, and allowing for each person say \$20		12,000
Of 600 persons sick we may say that one-third were bread-winners, earning, let us say, \$2.00 per day, one-third of 600=200. Average period of sickness 20 days.		8,000
		<hr/> \$47,000 <hr/>

In this calculation only one disease has been taken into consideration, though there are other diseases, such as scarlet fever, diphtheria, dysentery, etc., that depend upon like causes. No estimate, moreover, has been made for the funeral expenses of those who died, which, if added, would probably swell the amount to \$50,000, most of which would have been saved to the body politic, had proper sanitary measures been maintained.

Apart from the question of humanity, such an unnecessary and burthensome loss should tend to strengthen the hand of health officers in their endeavors to strangle and stamp out infectious disease: but unluckily there are always to be found in every community certain individuals who have no inclination to enlarge their views beyond that contracted sphere in which they are appointed to move, and who are, consequently, prone to treat all sanitary provisions with indifference, and look upon sanitary officers as officious intermeddlers, whose only function is to interfere with personal rights. Let not the people be deceived by this foolish talk about "personal liberty," which, in this connection, is just another name for *personal selfishness*. It is a false and vicious liberty, that permits one individual to destroy the health and life of another by maintaining a nuisance, even if it be on his own property. Such liberty means slavery to your neighbor.

You may claim that this is an affair of the moral sense, and not of the law, and that you are within your rights when you give the first consideration to your own interests. That may or may not be the case, as we view it from different stand-points; but you are certainly not within your rights when you show indifference to the welfare of your neighbors. It should be remembered that one man's selfish interests may be another man's poison, and one man's liberty may be another man's death. No man is at liberty, under the laws of the State, to poison his neighbor, and so no man should be allowed to injure or give disease to his neighbor by practices which

are in direct conflict alike with the sanitary laws of the State and the dictates of a common humanity.

Sanitary progress demands many things—a proper direction on the part of the State Board of Health, a policy of education rather than coercion, a gradual development as against hasty interference, intelligent co-operation on the part of the local authorities, a certain knowledge of sanitary cause and effect, a steady sense of public duty. In no part of life is the need of a broad conception of the interdependence of the various members of the body politic so pressing.

DRAINS AND SEWERS.

The removal of surface and subsoil water constitutes an important feature in the sanitation of all towns, and it may not, therefore, be out of place to explain, in a few words, the difference between a sewer and a drain, before treating of the one or the other in detail. A sewer is a pipe for removing impure water, or water that has been fouled; a drain is intended to take the wetness out of the soil, or, in other words, to dry the soil; it is not for the purpose of carrying away impure water.

Now, as it is the function of sewers to carry away impure water, it is obvious that they should be impervious to water, otherwise they would, on certain occasions, let their contents leak out into the subsoil of the town, underneath houses, and also into wells or springs if there are any. But if the pipe is impervious the soil or subsoil water cannot enter it, and therefore it cannot act as a drain, except in so far as the subsoil water may follow the line of the sewer pipe on its outer side. In this way sewers are capable, to a certain extent, of acting as drains also. Again, a sewer may be so constructed as to act both as a sewer and a drain. That end is attained by setting the bricks of the invert, as it is termed, in cement, and setting the others, or those above the level of the usual flow of sewage, in mortar, in order that the

soil water may pass into the sewer by imbibition or capillary attraction. These drain sewers, it may be remarked, are on the plan of the oldest sewers we know of, namely, the Cloaca Maxima of Rome, which, however, was not constructed originally as a sewer, but for the purpose of draining off the water from the Forum, which it does to this day. It only came to be used as a sewer afterwards, that is to say, to have refuse matters thrown into it. The adverse criticisms which have been passed upon the Romans for not making the Cloaca Maxima impervious would seem, therefore, to be unjust. "Main sewers and drains should be adapted," as Mr. Rowlison, the great English engineer, has said, "to the town area, length of streets, number of houses, surface area of house yards and roofs, number of street gullies, and volume of water-supply."

NATURAL DRAINAGE.

The direction of the long axis of the elevations and depressions in Cumberland is generally South, 20 degrees West. Through the depressions flow a series of water-ways, which form the natural drains of the city, and finally empty into the Potomac river, for the most part above the canal dam. Of these streams Wills' Creek, supplemented by an old mill race supplied with water by a dam across the creek above the Baltimore and Ohio Railroad viaduct, forms the most important part of the drainage system of the city. It drains the northern and central divisions of the city, and flows in a generally southern direction until it empties into the Potomac river above the canal dam.

At a point just south of the railroad viaduct above referred to "Dry Run" empties into Wills' Creek. This run drains a large section of country, extending probably nine or ten miles, with an average width of about one mile. Wills' Creek is also the natural drainage

channel for all surface drainage from the eastern slope of the western section of the city.

What is known as "The Race" supplies the next most important drainage channel in the city. It runs parallel with the creek, and in its course receives the drainage of a large section of the eastern side of the city, and from Bedford Road, which covers an area of one square mile. It also receives, at the foot of Mechanic street, the drainage from a sewer built by the Baltimore and Ohio Railroad Company, which has an area of cross section of about nine square feet. The Race empties into the main basin of the canal, from which ice is taken during the winter, chiefly for manufacturing purposes. It was stated, however, that considerable quantities of this filthy ice had been used for dietetic purposes also.

During high water in the Potomac the river water enters the creek and "backs up" into the densely settled parts of the city, leaving behind it accumulations of mud and silt in the bed of the lower part of the creek, and a large deposit of organic matter upon its banks, which rapidly decomposes and becomes offensive as the water falls and exposes it to the action of sun and air. In addition to this source of pollution there are a large number of privies, built directly over the creek and race, or upon their banks, the contents of which are discharged directly into the waters, while the surface and sipe water, for a distance of several hundred feet in many localities, is also contaminated with faecal filth from surface privies, overflowing and leaky vaults, &c.

On the west side of the city "Sulphur Spring Run" is the principal drainage channel. It runs from Rose Hill Cemetery to the Potomac river, into which it empties about 400 feet above the water-works. Up to July or August last the city water supply was pumped directly from the river below the mouth of Sulphur Spring Run, and consequently was contaminated with all the filth brought down by this run, including sipage from the

grave-yard. Now the water is taken from the river at a point about 900 feet above this run.

A SEWERAGE SYSTEM NEEDED.

There are practically no sewers in Cumberland. While the natural facilities for surface drainage are ample, they have not only not been fully utilized or preserved, but in many instances they have been materially impaired, and in some entirely destroyed by changes in the original conformation. With an extremely retentive soil this obstruction renders unpaved streets and alleys almost impassable during wet weather, and really accounts for the large proportion of damp or wet cellars and basements. There are several private drain pipes (eight and six inch terra cotta pipes) from dwellings to the creek from the west side, and to the "Race" from the east side. In times of low water these private sewers empty their foul contents on the banks of these streams, which become very offensive in warm weather. That some system of sewage disposal is absolutely necessary for the comfort and protection of the community goes without saying. It is an important subject and one which should be thoroughly considered. On several occasions I have discussed the question with Mr. Gaffney, the City Engineer, who certainly has a clear conception of what the city needs in this and other respects, and I take great pleasure in giving place to his views, as a valuable contribution to the sanitary literature of Cumberland. Mr. Gaffney says:

"You ask me to suggest some system of sewage disposal. This is a very important subject, and one which must be thoroughly studied. I can give you but a bare outline of what I consider absolutely necessary. On looking at the map of the city one would naturally suppose that Wills' Creek or the Race would be the natural main artery of the city sewage, but as Wills' Creek flows into the Potomac above the canal dam, across the latter, and the race empties into the canal basin, both of these have their outlets

too high and too near the centre of the city. They could not or should not, therefore, be availed of to carry off the city sewage. A large main sewer could be constructed parallel to these—down Centre street, probably, and continued down, parallel to the canal basin, through South Cumberland to a point where it could be carried *under* the canal and into the river. This would give a fall of about thirty feet in two miles, and would empty the sewage into the river below the city and dam, where it would do no injury. Into this main sewer lateral sewers should be run, commencing at Dry Run, and, as might be found necessary, one down Hanover street, Bedford street, Frederic, Baltimore, Union, Harrison and Williams Road, &c. Connecting these sewers at their heads, sewers should be built along Independent, Columbia and Decatur streets. These sewers would intercept the drainage from the hills on the eastern side of the city.

“The sewage of the western half of the city would be more difficult to dispose of, as it is entirely above the Potomac dam. To dispose of it so that it would not pollute the waters of the Potomac and Wills’ Creek, within the city limits, it should be carried *under* the river and deposited below the dam. An intercepting sewer down Green street to Water street, and one along Water street from Ladew’s tannery, both emptying into the river at its confluence with Wills’ Creek, would prevent any sewage emptying into the river above the water works, and into Wills’ Creek above the Baltimore street bridge across the creek. The water is seldom less than six or eight feet deep above the dam, and the sewage would not be exposed to the influence of the sun at low stages of the water. This about covers all the ground for the present and near future of the city requirements. If the city grows to any much larger proportions, the expansion will be all mostly southwards, where a drainage system will be very simple and inexpensive in comparison with what is necessary for the present city limits.

“There are at present 74 streets in the city, amounting to 21 miles in aggregate length, and 80 alleys, aggregating $6\frac{1}{4}$ miles. Of these streets there are $7\frac{1}{2}$ miles paved, $\frac{1}{2}$ of a mile with brick and 7 miles with cobble stones. We have a committee of the City Council on streets and alleys and a street superintendent, whose duty it is to have the streets and alleys cleaned. Most of the cleaning, however, is done on the principal streets of the city. The alleys are sadly neglected. The City Engineer has no authority in the matter, or in any other matter appertaining to city affairs. Like the City Attorney, he is supposed to give his opinion upon matters concerning his profession only when it is asked for. The railroad companies, so far as I have observed, keep their tracks

and right of way clear of all refuse matter and dirt. I know that the railroad with which I am connected as chief engineer does, and always has done so, on principle, along the whole length of its lines."

The plan of Mr. Gaffney, which contemplates discharging all the sewage of Cumberland into the Potomac river below the dam, when considered only with reference to the City of Cumberland, is no doubt most excellent, but there are other circumstances to be considered. Nothing is more certain than that the discharge of crude sewage into a river in any considerable quantity is inadvisable. It is, in fact, a method of shifting a nuisance from the nuisance producer to his neighbor lower down the river. In any event the outfall would have to be below the contemplated work shops of the Baltimore and Ohio Railroad Company. The evils arising from such discharge depend mainly upon the suspended matter in the sewage. This, first of all, floats about near the outfall. Certain portions of the organic matter combining with aluminous compounds from alluvial mud, brought down by freshets, and in time deposition takes place, the various ingredients being deposited more or less in the order of their specific gravity.

The organic impurities of the sewage in this manner collect on the banks and in the bed of the river and ultimately putrefy, which is the case with the bed of the river above the dam at this time. The gases developed and bottled up in time render the solids sufficiently buoyant to rise to the surface, where the gases of putrefaction are given off, the solid matters again sinking to undergo fresh putrefactive changes. Thus the nuisance from the discharge of sewage into the river may be far more offensive at some distance from the outfall than at the outfall itself.

As regards the matters in solution, provided the sewage be sufficiently diluted and allowed a certain flow,

complete purification will be effected by oxidation. This fact is now admitted by nearly all chemists, and need not detain us further. The self-purification of running water is, however, not to be regarded as an argument in support of allowing crude sewage to be discharged into a river, and the general government will, no doubt, be forced at an early period to enact a law to protect the water supply of Washington City against such an evil.

In 1875 a committee of the Local Government Board of England, appointed to make a special inquiry into the systems of sewage disposal then in operation, reported, in part, as follows:

“4. That most rivers and streams are polluted by a discharge into them of crude sewage, *which practice is highly objectionable.*”

“5. That the treatment of sewage by deposition and chemical precipitation effects a considerable improvement, and when carried to its greatest perfection, may be accepted.”

“7. That town sewage can best be disposed of and purified by the process of land irrigation for agricultural purposes, where local conditions are favorable to its application.”

“8. That land irrigation is not practicable in all cases, and, therefore, other modes of dealing with sewage must be allowed.”

This being the sewage with which the City of Cumberland has to deal, the object to be attained is twofold:

(1) To make use of any valuable constituents that it may contain; and

(2) To purify it.

Sanitary requirements, however, demand that no nuisance should result in the course of the operation of treatment.

That it is necessary to get rid of refuse matters generally, and especially so of this particular kind of refuse matter, from the neighborhood of habitations is now regarded as axiomatic. I could quote from any number of authors showing that the general death-rate from certain specific diseases, especially typhoid fever and cholera, depends to a very great extent upon the amount of filth,

and especially of excretal filth, that is in and about the habitations of people.

Take the following opinion from the evidence given by Mr. Kelsey before the Commission on the Health of Towns in England. When asked, "Does the state of filth and the effluvia caused by defective sewerage, by cesspools or privies, and decomposing refuse, powerfully affect the health of the population?" he answered, "Yes, it does; it always occasions a state of depression that renders persons more liable to be acted on by other poisons, even if it be not the actual cause of it. The line of habitations badly cleansed, and in the condition above referred to, *will almost certainly form the line of typhoid fever, diphtheria, scarlet fever and cholera.*"

Referring to the cost of constructing adequate sewers for towns and villages, the following from the *Sanitary News*, of March 14th, 1891, will serve to show that the expense involved is not so great as is generally supposed.

.. Many small towns are prevented from introducing sewers and enjoying the more approved sanitary conditions thereby secured, by a false impression of the expense involved. The old-time sewerage system which provided for storm water as well as sewage proper, required very large, costly sewer pipes. An objection to this system is the washing into the pipes of considerable quantities of sand and gravel, which form dams at frequent intervals, causing the sewage to accumulate in pools, and filling the pipes with offensive gases, which sooner or later find their way into the homes connected with the sewage system. The modern 'separate system' of sewerage provides two separate pipes, one for carrying away the storm water, the other for the sewage, and is much less expensive, as sewers must be made absolutely impervious, while for storm water ordinary drains will answer. In some towns, indeed, on a high or rolling situation, the storm water may be carried off by surface drainage. It is found that small pipes answer the purpose of sewage conduction much better than large pipes, as the stream more nearly fills the pipe, flows more freely, and thus keeps the pipes freer from sediment. An eight-inch sewer laid at a grade of even one foot in one hundred will, it is said, carry away much more sewage than will be discharged from a row of houses, each with forty feet 'front', two miles long, each house occupied by

five persons, it being supposed that each person will furnish not less than 60 to 80 gallons per day of sewage or contaminated water. It has been estimated that in average soils an eight-inch sewer pipe can be laid at an expense, including cost of pipe, of less than two thousand dollars per mile, the expense to each forty feet of front being only about \$10.60, and the interest at 4 per cent., forty-two cents a year, or eight cents per head of occupants. With a sinking fund to pay off the principal in 20 or 40 years, so that the next generation, who would receive equal benefit, would aid in the payment, the yearly cost would be far less than is constantly being paid almost daily for some trifling, useless or injurious luxury."

CESSPITS AND CESSPOOLS.

The most usual plan of getting rid of excretal matters in Cumberland is to dig a hole in the ground and discharge all this refuse matter into it. When this is done, unless the hole in the ground is impervious, a great amount of the refuse matter will percolate into the earth around, and get into the wells or springs, and in some instances this has been actually encouraged, with the express, distinct and avowed object of letting the liquid matters, and as much as possible of the solid matters, percolate the soil and get away as best they can. These dumb wells, as they may be termed, have been made and shut up with the deliberate intention of not being opened for many years, and in certain places the soil has been so absorbent that when opened the wells have been found empty. Now that plan need only be stated to be condemned, for wherever they exist the well water near them, which is extensively used, is largely polluted, and is in fact to a great extent supplied by these very dumb wells. In almost every town where there is an epidemic of typhoid fever this condition has been found to exist.

An improvement on this bad plan, or want of plan, would be to line the pits with cement, and provide a drain from them into the nearest sewer or water-way. Another plan is to do as is done in Paris, where typhoid

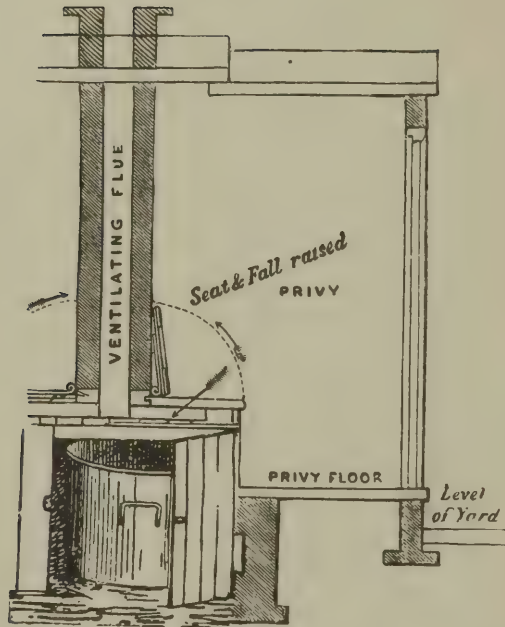
fever prevails at all times—make these large cesspools (so large that they take six months, or even a year, to fill) under the houses, or under the courts, impervious, and not drain them at all. Of course the pits are only theoretically impervious, but practically very many of them certainly are not so. But, supposing they are, they in any case require a ventilating shaft, or the foul air which collects in them will find its way through, somehow or other, and will poison the air of the house.

The disadvantage of the Paris plan, apart from the general disadvantage of having such a thing as an immense cesspool in the yard or underneath each house, is found in the emptying of them. This operation causes a fearful nuisance, although they may be emptied as in Baltimore, by means of a large tank on wheels, in which a partial vacuum is first created, so that when the hose is attached to the tank and placed into the pit, the semi-liquid stuff rises up and fills the tank. As a matter of fact, this system is expensive, as well as unhealthy.

SIMPLE METHODS OF SEWAGE DISPOSAL.

Some one of the so-called dry systems is probably the only plan that will suit the existing conditions in Cumberland. There is one known as the Manchester plan, another as the Rochdale plan, and still another known as the Hull plan, and lastly Moule's dry earth closet; but in all these the ashes are thrown into the pit or vessel in which the excreta are collected, so as to make a semi-solid mass. The conditions necessary for them are these: In the first place, they must receive no moisture from the soil around; in the second place, they must allow no liquid to escape from them, because, if so, they are confessedly failures.

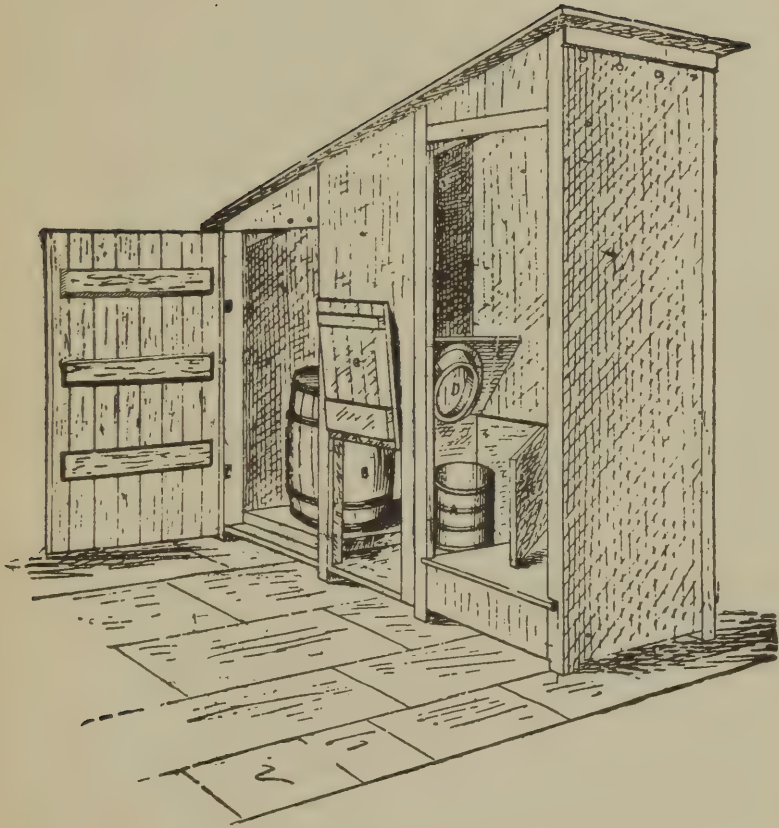
FIG. 1.



The Manchester Method, Fig. 1, consists of a common privy outside the house, constructed with a sunken pit, in which stands a galvanized iron receptacle, placed under the seat of the closet. The floor of the pit is of earthenware, and the ventilation is through the flue, as shown in the illustration. The door for removing the receptacle is at the side or back. In the absence of the receptacle, the ashpit can be used. The receptacle is emptied weekly.

The Rochdale Method is similar to the Manchester, except that the wooden pail, generally made from a kerosine barrel, is substituted for iron, and sits immediately beneath the closet seat and on the same level of the floor, instead of below the surface of the ground, which makes removal more difficult. Fig. 2 is an illustration of the Rochdale system.

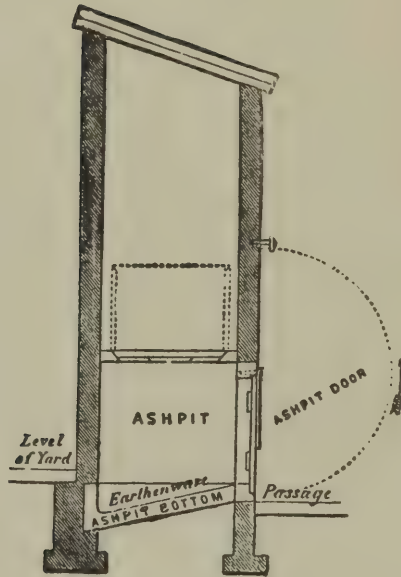
FIG. 2.



ROCHDALE PAIL CLOSET.

- A. excrement pail.*
- B. ash tub.*
- C. seat cover (raised).*
- D. iron collar below seat, reaching slightly into pail when cover is down.*
- F. hinged upright of seat.*
- G. door admitting from outside to excrement pail.*

FIG. 3.



The general principle of the ashpit midden or Hull system is illustrated in Fig. 3. It consists of a common privy, with a small covered ashpit, from the top of which a ventilating shaft is taken to the roof of the house to which it is attached. The floor of the ashpit is of glazed earthenware, absolutely water-tight. The ashes used as an absorbent are emptied into the pit through the privy seat, whenever the closet is used. These pits are cleaned as often as may be necessary.

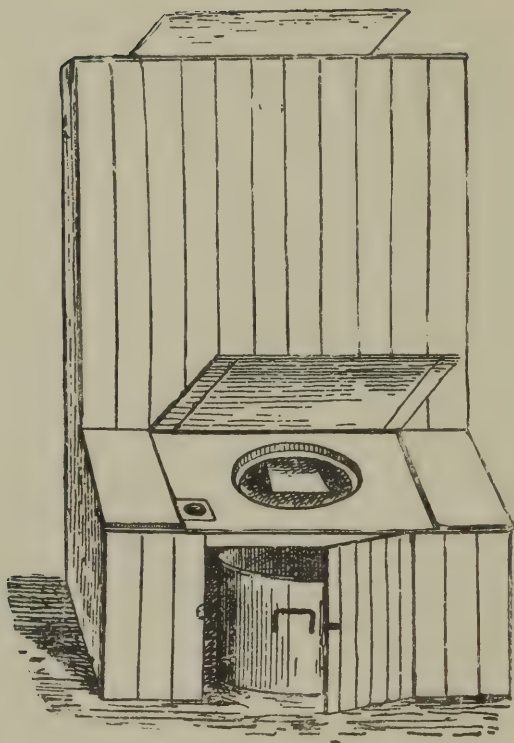
With either of these systems it is desirable for sanitary reasons, though not for economical reasons, to have the receptacle as small as possible, in order that as little of these matters shall be retained about the premises as possible. The midden closet used at Hull consists of an impervious receptacle, which is not sunk in the ground, but is, in fact, merely the space directly under the seat of the closet, the front board being movable, so that the

scavenger can get the stuff when full. That, no doubt, is the best of these simple closets.

After this we pass on to another arrangement, which is in fact a temporary cesspool—that is to say, a simple tub or box placed underneath the seat to collect the excretal matters, these tubs or boxes being collected every day by contractors and their contents used for manure. This is really the system out of which most is gotten in the way of profit. It has been practiced in China for thousands of years, and is now used in the neighborhood of Nice, in the South of France, where they grow orange trees and scented flowers, and other things which require rich manure. Above all, it is the system in which there is least waste. Of course, the difficulties of the system are enormous, and the nuisance is considerable; but there is no doubt whatever of the fact, that for small places, where water-closets do not prevail, it is infinitely a more healthy and more reasonable system in every way than either of the other plans that we have thus far considered. In China, as also in Edinburg and Glasgow, it is carried out with a simple bucket, in which the refuse matters cannot be allowed to remain for a long time, because the vessels are small and the matter would become offensive. This system is evidently better for health than keeping the matters about the premises for a long time in pits.

Lastly, we have among the dry systems of collection Moule's Dry Earth Closet, in which the deodorizing and absorbent power of the earth is applied to the treatment of excreta. This closet is illustrated in Fig. 4.

FIG. 4.



The dry earth closet has been much praised, but it requires great care and attention to prevent its getting into a state of nuisance; it is ill-suited for general use in a town. In the first place, the earth used in it must be dried, and, in the second place, it must be deposited on the refuse matters *in detail*—that is to say, you must not take a great heap of excretal matter and throw a lot of dry earth on it, but you must throw a little earth upon each separate heap that is deposited. It is found that about four pounds and a half of dry earth is required to deodorize the excretal matters that are passed in twenty-four hours by an individual.

With this system it is a *sine qua non* that no liquids are to be thrown into the earth closet. If any liquids are accidentally thrown in, or if, as is the case in certain places and at certain times, the air is very damp, or if the contents of the closet get moist in any way you have, to all intents and purposes, a cesspool without its advantages, or without the special precautions that are commonly taken with regard to cesspools.

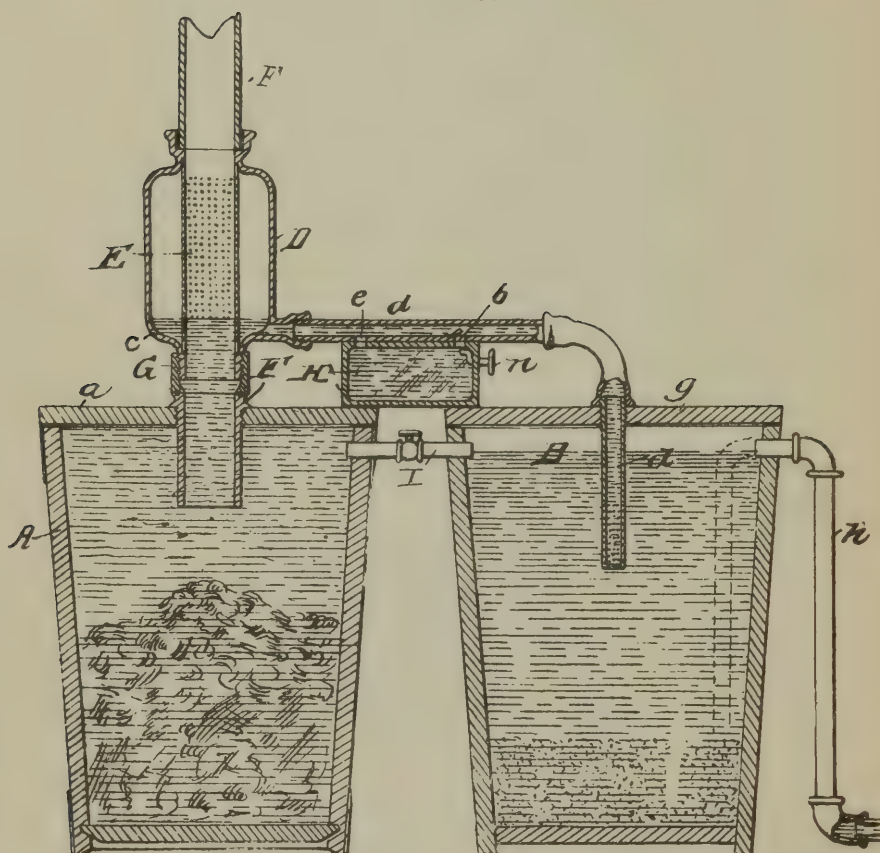
A NEW SYSTEM.

I may be permitted to say a few words about a system which I have recently introduced and which is coming into quite general use in houses provided with water-closets. This method consists simply in a process by which the solid matters are effectively separated from the liquids of excretal sewage by mechanical straining, subsidence and chemical precipitation, whereby the solid suspended matters are detained in hermetically closed receptacles, which when full can be readily removed and replaced with empty ones by a common laborer, while the effluents or liquid parts are continuously delivered in such a condition of purity that they may be sent into any drain, sewer, well, stream or water-way, without silting up the bed, or causing nuisance.

The apparatus is attached to the lower end of the soil pipe leading from the closet, and the separation of the solids from the liquids of crude sewage as it passes from the closet is effected, (1) by means of a well devised screen or strainer; (2) by discharging the solid matters thus separated under a column or bed of water in a closed receptacle; (3) by precipitating the finer suspended matters in a second receptacle or precipitating tank; and (4) by discharging the overflow from the precipitating tank at any convenient place, or disposing of it by sub-surface irrigation.

The accompanying drawing, Fig. 5, representing a vertical section of the apparatus, illustrates the entire device:

FIG. 5.



- A.* Receiving vessel.
- B.* Precipitating tank.
- D.* Outer cylinder of strainer.
- E.* Inner perforated cylinder of strainer.
- F. F.* Soil pipe.
- G.* Cellar connecting soil pipe with "receiver."
- H.* Box for precipitating reagents.
- d.* Pipe for strainer to precipitating tank.
- h.* Discharge pipe.

A, represents the receiving vessel or "receiver;" B, the settling vessel or "precipitating tank;" D, the outer cylinder of the "strainer;" E, the inner perforated cylinder of the "strainer;" FF, the soil pipe from the closet connected with the strainer above and below; G, the collar which connects the soil pipe with the receiver; H, the box or holder for the precipitating reagent; I, pipe connecting the receiver and precipitating tank for the purpose of drawing down the water to prevent slopping when the vessels are removed or changed. Through the meshes of the inner perforated cylinder E, which may be from $\frac{1}{10}$ to $\frac{1}{20}$ of an inch in diameter, the liquid sewage passes on its way to the precipitating tank, while the coarser solid matters are held back and sink into the "receiver." The bottom of the space between the outer and inner cylinders is a solid floor, C, which leads the strained liquid into the discharge pipe, D, which empties into the precipitating tank, on a level six or eight inches lower than the mouth of the exit pipe, H, through which the effluent from the precipitating tank is discharged.

This apparatus can not only be applied to the present water-closet system without any change whatever in the construction of the same, but admits of closet apparatus of a much more simple character than those now in use, and affords absolute protection against sewer gas. A receptacle of 400 pounds capacity—an ordinary whiskey barrel—will contain the solid excreta of ten persons using it daily for three or four months, so that the receptacle need only be changed or emptied once in that time.

STREET CLEANING AND GARBAGE.

There does not seem to be a well organized system for cleaning the streets and alleys of Cumberland, and some of the latter are mere repositories for filth of every kind. Theoretically, they are supposed to be cleaned by the

city, but practically the so-called cleaning is more a term used than an operation performed. Certain it is, much complaint is made of neglect in this respect, even as to the paved ways, and no pretense is made of going into the unpaved streets and alleys, in fact it would be hardly possible in wet weather to do so. No marked or radical improvement, therefore, is to be looked for in this direction until better highways are provided: but some relief might be secured (1) by taking advantage of favorable weather, during which the street force should be increased to the necessary capacity; and (2) by enacting and vigorously enforcing ordinances requiring the work to be pushed *pari passu* with the capacity for prompt removal. Tenants, occupants, or owners of property should be required to clean the gutters and sweep streets and alleys, bordering on their premises, for a space of at least four feet from the curbstone, and to pile up the cleanings in the centre of the street or alley for the garbage carts,—this to be done twice a week, the days for each ward or street to be designated by the Board of Health.

The city engineer, or superintendent of streets should be empowered to have such work done for delinquents and non-residents at their proper cost; and all railways should be required to clean the roadway between and for two feet on each side their tracks. Street crossings and intersections should be kept clean, and all street sweepings and garbage removed by the city. This would require at least 4 open carts of 32 cubic feet capacity for ashes and street sweepings, and two or three water-tight carts of the same capacity for wet and other garbage. At present there is no provision for the removal of either wet or dry garbage, and it is disposed of in every conceivable way—thrown on vacant lots, in alleys in the rear of premises, in yards, in disused cisterns and wells, in abandoned privy vaults, and gullies, into and on the banks of the several streams that flow through the city.

CELLARS AND BASEMENTS.

An important defect noticeable in some of the dwellings is the want of subventilation, the houses being built so close to the ground as to have no air-space beneath the floor, while others have insufficient or obstructed subventilation. In many of the buildings, especially in the principal business part of the city, the cellars are badly ventilated, damp and wet, with water standing from two inches to two feet deep on the floors, and with walls soaked by sipage from the surrounding polluted soil. As these cellars are seldom over 6 or 8 feet deep, any general system of sewerage and subsoil drainage would tend to remedy the defect.

Among other subterranean defects, quite a number of cellars were found to be fouled by accumulations of decomposing organic matter, and other materials. All wet cellars should be efficiently drained or emptied, disinfected and filled up; and all dirty cellars should be cleansed and whitewashed.

CONDEMNATION OF BUILDINGS.

In the detailed reports made by the several inspectors a number of structures have been recommended for destruction, or at least for such alterations and repairs as may be necessary to fit them for occupancy. These include some business houses, as well as worthless shanties and overcrowded rookeries, which rent for two or three dollars a month to the most squalid, filthy and degraded whites and blacks. These wretched dwellings, together with the poverty, ignorance, and sometimes crime, of those who occupy them, are incidents in the general condition of this class of the population in every city.

In dealing with this question much reluctance if not positive opposition may be anticipated from the owners of these houses, but the authorities should proceed on the assumption that such houses as are unfit for habita-

tion are public nuisances, and the community in such cases should compel the owner to put them in proper condition, or require them to be closed or demolished. It is certain that much more can be done than has yet been undertaken to require owners to keep their property in better sanitary condition, by the due enforcement of proper regulations: but for this purpose the local authorities must be strengthened by the hearty support of public opinion. It is the city and not the property owner that requires public sympathy. There is not the slightest danger that any injustice will be done the latter. When property is affected injuriously, the outcry which the owner makes is generally sufficient to correct the evil. Personal interests usually manage to take good care of themselves; it is the *public good* which is so often powerless and voiceless in the presence of the audacity of private wrong. A municipal government charged with the protection of the natural rights of the people has little chance against the eager, persistent and vociferous clamor of the "vested rights" of individuals with which it has to contend, and the experience of town authorities in enforcing the most moderate precautions for the preservation of health and the safety of life has not been encouraging.

The wretched condition to which the poorer classes are sometimes reduced, and the hovels which they are sometimes forced to occupy, often have an influence on diseases that will more than counter-balance the boasted salubrity of any community. The law should make it an offence punishable by heavy fine to own or rent property for habitation which is unfit for the purpose. It is very well worth the while of the people of Cumberland to face this question and to solve it. To punish neglect or indifference to sanitary provisions is a question simply between the rights of property and the rights of the community, and until this fact is faced no reform will be possible.

UNSANITARY SCHOOL HOUSES.

Among the imperfections of construction found in some of the public schools of Cumberland, in several instances, the outside "offices" were found to be abominably filthy and shocking to every sense of decency. Every school, whether public or private, should be under sanitary supervision, and the sanitary authorities should have the power of prohibiting any building or room being used for school purposes where the sanitary conditions are not in all respects satisfactory. For a more detailed account of the sanitary conditions of the schools of Cumberland, reference is invited to the report of Prof. Wm. P. Tonry, who was specially designated to make an inspection of these places.

VACCINATION NEGLECTED.

In spite of the incalculable benefits conferred by vaccination, and the statute which makes it "compulsory" in this State, it was found, as already stated in my preliminary report, that more than fifty per cent. of the children attending schools—public and private—were unvaccinated. This leads me to say a few words as to the protective power of vaccination, and when it should be performed.

The beneficial results of vaccination are now so plainly evident that, it has been said, "it would be more rational to deny the daily rotation of the earth upon its axis, or to doubt the truth of the laws of gravitation, than to question the salutary effects of vaccination." In the German army where vaccination of the soldiers is required to be regularly performed, at intervals of a few years, epidemics of small-pox are unknown. The trial of revaccination in that army has conclusively demonstrated the efficacy of the measure as a means of getting rid of small-pox altogether. One-fourth of the total mortality from small-pox in this country occurs in chil-

dren under five years of age, who have not been vaccinated; and hence, the great risk of delay. Healthy children living in large towns should be vaccinated when about four months old,—in more delicate children it may be postponed a month or two longer; but all, except those whose health positively contraindicates it, should be vaccinated before the age of six months.

It may be stated generally that persons who have been successfully vaccinated are, as a rule, protected. It is, however, a very proper precaution that every one should be revaccinated every ten or twelve years, and oftener if small-pox prevails. In a great many it does not “take” as it is called, and this merely indicates that the susceptibility to the disease has not returned; or that the virus used is defective. In a considerable proportion a second vaccination will take as perfectly, or nearly as perfectly, as in an infant. Were vaccination and revaccination properly attended to, we should hear no more of small-pox, which be it said is now prevailing, in a sporadic form, in some of the Middle and Western States. To exclude the disease from our State would be, certainly, a very desirable consummation, and altogether possible; but I fear it will not be arrived at, practically, if other communities in the State are as derelict, in this respect, as Cumberland has been. Prejudice and indifference are formidable enemies to overcome, but the good sense of the people of Cumberland will no doubt triumph in the end, to the extent at least of confining the disease, should it occur, within the narrowest possible limits.

We can never expect to get rid of sickness altogether, for susceptibility to diseases is a law of our nature, and where we have to deal with the phenomena of life, vitality introduces a disturbing element, which we can never expect to get the better of; but we may safely look forward to a period when we shall be able to undertake a more equal struggle with disease,—a period when the success of the sanitarian shall be more nearly than at present on a level with his good intentions.

The following table shows the number of deaths from small-pox in each million of inhabitants in some of the European Countries in which vaccination is optional, and in an equal number where it is compulsory, from which it will be seen that in the former the pestilence still prevails, while in the latter it is almost wholly extinct:

		1887.	1888.
Austria—Hungary,	} Vaccination Optional,	583.7	540.4
Russia,		535.9	231.5
France,		167.0	191.9
German Empire,	} Vaccination Compulsory,	1.8	0.8
Denmark,		0.0	0.0
Sweden and Norway,		0.0	0.0

There is no preventive against small-pox so certain as vaccination, and if this fact could only be fully impressed upon the minds of the people, and they could be led to appreciate its truth, the day would not be far distant when we should have as little fear from an invasion of the disease as the people of Germany, Denmark and Sweden, where "Compulsory law" means *compulsion*, absolute and irresistible.

MORTALITY FROM ALL CAUSES.

An analysis of the mortality records of Cumberland, for the years 1889, 1890 and 1891, furnishes the following table.*

* The data given is from *The Courier*, a weekly paper published in Cumberland, C. E. Hambright, Publisher and Manager.

DEATHS IN 1800.

Months.	Children under five years.	Male.	Female.	White.	Colored.	City Total.	Vicinity.
Jan ...	14	4	1	18	1	19	16
Feb ...	16	2	5	19	4	23	16
Mar ...	18	4	8	24	6	30	16
April...	15	7	7	26	3	29	19
May...	8	8	8	20	4	24	15
June...	12	5	5	21	1	22	10
July...	15	8	1	15	9	24	13
Aug...	7	5	8	18	2	20	18
Sept...	12	6	7	21	4	25	5
Oct...	9	7	1	14	3	17	7
Nov...	6	5	6	15	2	17	12
Dec...	9	4	4	13	4	17	7
Total..	141	65	61	224	43	267	154

DEATHS IN 1890.

Months.	Children under ten years.	Male.	Female.	White.	Colored.	City Total.	Vicinity.
Jan ...	8	10	17	30	5	25	10
Feb ...	13	15	10	38	0	29	9
Mar...	27	26	22	71	5	51	25
April.	14	12	14	37	3	22	18
May...	16	13	14	41	2	26	17
June...	9	9	11	26	3	19	10
July...	15	8	8	29	2	17	14
Aug...	14	7	18	34	1	22	13
Sept...	9	2	17	16	2	8	10
Oct...	8	5	8	21	0	11	10
Nov...	12	13	11	34	0	18	16
Dec ...	10	5	6	18	3	15	6
Total..	155	125	154	395	26	263	158

DEATHS IN JANUARY AND FEBRUARY, 1891.

Months.	Children under ten years.	Male.	Female.	White.	Colored.	City Total.	Vicinity.
Jan. 3..	6	4	2	11	1	7	5
" 10..	3	0	2	1	1	3	2
" 17..	4	3	3	8	1	4	6
" 24..	1	1	2	3	1	2	2
" 31..	2	4	7	13	0	10	3
Feb. 7..	3	4	4	11	0	8	3
" 14..	5	1	4	9	1	7	3
" 21..	6	5	2	13	0	8	5
" 28..	0	4	1	5	0	1	4
Total }							
for 2 mos. }							

From Paper published Jan. 11, 1890.

Making a total of 421 deaths for the year; 259 of which were reported from January to July, and 162 from July to January. The death rate for March was nearly double that of any other month.—From paper published Jan. 3, 1891.

TRACING THE DISEASE.

The pathological identity of the Cumberland fever, which I have termed "Entero-Miasmatic Fever," with true enteric or typhoid fever, has not, in the absence of post-mortem examinations, which could not be obtained, been clearly established. A large proportion of the cases have been mild; diarrhœa and rash have been absent in many cases, as well as grave bowel symptoms; frequently along with fairly typical cases, there have been in the same family, successively, cases departing widely from type, and often characterized by well marked periods of remission, so much so that one of the leading physicians thinks it may be properly termed a type of Remittent Bilious Fever, while others have stoutly maintained its identity with typhoid fever. Many of the cases are certainly anomalous, but the bacteriological examinations, as will be seen by the report of Dr. Miller, have revealed

the specific typhoid germ, *in the excreta* of a patient in whom many of the objective and subjective characteristics of genuine typhoid fever were already recognized. The diversity in the non-essential phenomena may be explained by individual peculiarities of age, constitution, etc., but in the presence of the specific germ, it is not difficult to fix the identity of the disease with that of true enteric fever.

The existence of a pathogenic micro-organism in drinking water as a condition precedent of Typhoid Fever, though strongly upheld by some physicians, especially on the Continent, is considered by English observers as not yet proved. Sir W. Moore, in a discussion on the subject in the Epidemiological Society of London, January, 1891, held that the specific germ was a pure assumption, and that enteric (typhoid) fever was multiform, indefinite, and due to a variety of causes. The question as stated by the *London Lancet*, October, 1890, is, "Whether the property of infection is an adventitious one depending upon the soil in which the organism grows, or inherent in its substance?"

In commenting upon the experiments of Rodet and Roux, heretofore referred to, the *London Lancet* remarks: "Certainly none more practical could engage the attention of bacteriologists. If confirmed, the term *pathogenic fever*, introduced many years ago by Murchison, may yet be generally accepted as the proper one for the disease which is now somewhat vaguely styled typhoid or enteric fever."

The disease is undoubtedly a typical filth disease, and, without reference to the question, whether it may originate in, or be caused by, the products of putrid animal matter, its prevalence unquestionably bears a constant relation to the condition of sanitary surroundings. Where there is a polluted water-supply; where there is undrained ground, contaminated with excremental filth; where foul, overflowing or leaky privy vaults soak the earth for yards around with their contents; where defective, unventi-

lated sewers and "skin" plumbing abound, there will this fever find a congenial *habitat*, and its most numerous victims. In such localities the infection, or *materies morbi*, will originate and spread, and finding its way by various unsuspected channels, may invade the most cleanly and carefully ordered household.

The most frequent mode of propagation is undoubtedly the water-supply. A small quantity of the infective matter is sufficient to poison the contents of a well or cistern, or even a river, and thus to give rise to an outbreak among the susceptible who depend upon such source of supply. This infective matter or poison, whether it be a modified bacillus *coli*, or a specific germ, exists principally in the discharges from the bowels of those suffering with the disease; and so well has the deadly character of such discharges been established, that in Europe attempts have been made to secure legislation enforcing by statute provisions the compulsory disinfection of the intestinal evacuations of all patients suffering with typhoid fever or cholera. This of course would be impracticable in this country; but upon the "Family Physician" should rest the responsibility of seeing that thorough disinfection is carried out in every case of cholera or typhoid fever he may be called to attend.

A remarkably clear example of the relation of drinking water to typhoid fever occurred in 1885, at Plymouth, a small city in Luzerne County, Pa.

I quote from the comprehensive report of the committee sent by the Mayor of Philadelphia to investigate the subject as follows:

"The mountain stream is a small one, running down over a rocky bed, and on a declivity not eighty feet from its bed a dwelling is situated, wherein, during January, February and March, was located a case of typhoid fever that is only now convalescent, the worst period of the case being about the 30th of March. The attending nurse was in the habit, during each night, of carrying the excreta from the patient and depositing it on the ground towards the stream. The ground, during all this time, was frozen

and covered with snow, until the thaw and rain already alluded to occurred. The poisonous character of the dejecta is not destroyed by freezing, but is only kept in a state of hibernation. A great part of the three months' accumulation of dejecta was suddenly swept into the rapidly-running stream, and reached the lower reservoir as quickly as a man walking fast would have arrived there.

"In fifteen days from this time the epidemic began, fifty cases occurring daily between the 10th and 20th of April. Up to the present twelve hundred people have been sick, and one hundred have died, out of a population of eight thousand. For the first three weeks the few people in the town who used well-water exclusively escaped the disease. The period of incubation varies from ten to twenty days, or longer, and therefore no other conclusion can be arrived at than that the infective poison existed in the mountain stream water, and originated from the one case of fever in the house on the side of the stream."

Dr. Brouardel, the celebrated hygienist of Paris, who has paid great attention to the water question, in a report made on the epidemic of typhoid fever at Pierrefonds, has demonstrated that the bacilli of this disease will live during many months in the earth, and are carried by rains into water supplies a considerable distance from the place where the dejections are thrown or deposited.

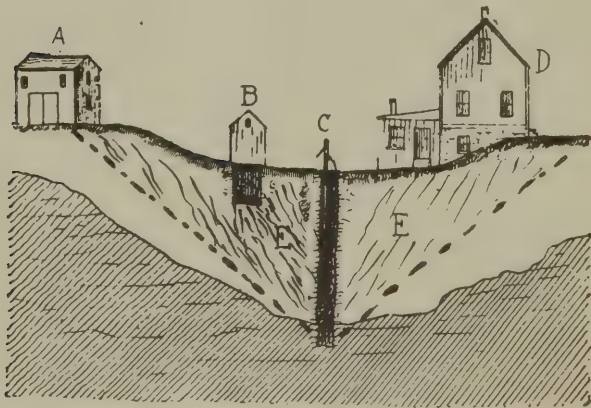
Seeing then that the faecal discharges of persons suffering from certain diseases are full of the microbes of those diseases, or at least certain bacilli which are capable of degenerating into disease germs under favorable circumstances, it is easy to comprehend how the percolation of such material into any source of drinking water may be fraught with disastrous consequences. It is indispensable to the health of communities, therefore, that the utmost care be taken to preserve the purity of water supplies, and to guard them with increasing care against every source of contamination.

The water of shallow or dug wells is always to be suspected, especially as the water in such wells is generally badly aerated, and is likely to contain extraneous and unhealthy matters. River water, which is excellent, if it has not been subjected to contaminating influ-

ences, depends for its purity, so far as suspended matter, such as muddy particles, is concerned, upon the nature of the surrounding soil and the velocity of the stream, but impurities of this kind are easily separated by means of filtration.

It is manifest that where the disposal of excrementitious matters are not made with proper care, and where the water supply for domestic purposes is drawn from superficial wells, the depth of which seldom reaches more than 20 or 30 feet and rarely exceeds 50 feet, there is great danger of contamination, since the filtering bed through which the refuse liquids percolate and are carried in their course by meteoric waters are insufficient to transform or disinfect all the poisonous organic matters which they contain.

FIG. 6.



14

The diagram, Fig. 6, illustrates how a well may be contaminated from surface drainage and soakage. Five cases of typhoid fever occurred in the family living in the house, and seven more among other persons using water from the same well.

This condition, important in a sanitary point of view, is characterized by the presence in the water of nitrates, nitrites, ammonia, chlorine, potash and organic matters notably in excess of those found in water drawn from unpolluted wells, or wells situated remotely from any source of pollution. It is quite well known to all who have paid attention to such matters, that water may be entirely limpid and tasteless and yet contain the same organic matters which are found in the most offensive liquid sewage.

It appears, moreover, from the evidence of scientific research, as well as from reasoning by analogy, that water may be contaminated by being mixed not only with the organic matter of sewage, but also by passing over or coming in contact with the polluted soil of graveyards, decomposing matters of cesspools and privies, or by the organic matter derived from the decay of any animal or vegetable organisms. But the most dangerous sources of contaminated water are undoubtedly the wells, springs, streams or rivers from which water is used for household purposes, and into which more or less excretal sewage has passed. Numerous cases in proof of this could be cited, but it is only necessary to give the following, which is indicative of general results in similar cases :

Mr. Burns relates that in a certain town of Scotland there was a severe outbreak of dysentery and typhoid fever. A physician, called to attend some of the cases, set to work to find out the cause. On inquiry as to the water supply, he was directed to a spring on low ground in the midst of the settlement, so situated as to receive the drainage from a cesspool. The water was pure and sparkling to the sight and taste, and was loudly praised by those who used it. A quantity put in a bottle and allowed to stand a few hours threw down a thick sediment of most offensive matter, which, on being tested, was found to be as purely excrementitious as if it had

been taken from a privy. The people ceased to use this water, and the epidemic disappeared at once.

In a village of New York typhoid fever broke out and prevailed with great violence in a certain locality. Search was made for the cause by the attending physician, but in vain. An appeal was made to the health authorities, and an expert officer examined the history of the outbreak and predicted that a certain hydrant which supplied the victims with drinking water communicated at some point with house drains or the street sewer. The water-pipe was examined, and at a distance from the hydrant a house drain was found leading into it at a point where they traversed each other. The repair of these pipes was the cure of the epidemic.

In a farm-house in Massachusetts, situated in an interior township famous for healthfulness and the beauty of its scenery, typhoid fever broke out in a violent form. Of eight members five perished and one was seriously ill. The house was situated on an elevation, and all its surroundings were admirably arranged for health. One could readily believe the statement that "there had not been a case of sickness in the house for twelve years." The following is a history of the sickness:*

"A few weeks before the disease appeared the pump in the well broke, and the farmer being pressed with work, neglected to have it repaired. Meantime the servants brought water from a spring at the foot of the hill, which soon became low, owing to a drought. Resort was then had to a small brook, and from this source the family were supplied with water for two weeks. This stream, higher up, ran through several farm yards, and received the surface drainage. The first symptoms of poison by this water were slight nausea and a mild diarrhoea. After several days typhoid fever in its worst form was ushered in. Of the entire family but two escaped an attack, and they did not use the water. An examination of this water revealed a sediment of excretal matters."

At Pittsfield, Massachusetts, typhoid fever suddenly broke out in a large boarding school for young ladies.

* Massachusetts State Board of Health Report.

The water was found to be contaminated with sewage, owing to leakage from the cesspool. A similar occurrence took place some years ago at Princeton College, New Jersey.

At Edgewood, on Staten Island, Professor Chandler relates that the inmates of a small block of houses were affected with typhoid fever, several deaths occurring. On making investigation, it was found that a neighbor through whose land the underground drain passed had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the wells, and murdering the unfortunate victims with sewage poison.

The process of filtration through the soil, which water derived from subterranean sources undergoes, tends to separate the organic impurities, animal and vegetable, but this process is often palpably insufficient to secure the requisite purity. The topographical and geological character of the site of the town, and of the soil and sub-strata, are also to be taken into consideration.

Professor Chandler has declared, in a paper on "The Sanitary Chemistry of Water," published in the reports of the American Public Health Association, that "many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters."

Dr. Macadam, a distinguished chemist of Edinburgh, Scotland, who has paid great attention to the water question, states that "the line must be distinctly drawn between non-putrescent organic matter and that which is putrescent. Impregnations from sewage form the most dreaded contamination, and yield waters which, though clear and sparkling, and cooling and refreshing, are yet most unwholesome and deadly."

It is obvious that infection of the soil by decaying organic matters will not only vitiate the subterranean waters, but also the air of dwellings to the extent of impairing health. Independently of the infected vola-

tile products which are evolved in the process of putrefaction, infective germs are sometimes concealed in the excretions, especially the dejections from cholera and typhoid patients.

The accumulation of the refuse matters of every-day life in the neighborhood of human habitations becomes more dangerous in proportion to the quantity accumulated, since the chances of infiltration, with its train of evil consequences such as vitiated air, polluted soil and contaminated water, are greatly multiplied.

There is a prevailing impression that the germs of typhoid fever are not communicated through the air we breathe, but are transmitted only by the absorption of the water we drink or the food we eat. A great number of observations, however, have shown this opinion to be erroneous, and it is now known that the disease can be communicated through the medium of infected air.

After studying the various ways by which typhoid fever may be propagated, Professor Bouchard, of the Faculty of Paris, says:

“The transmission of typhoid fever by polluted air rests upon evidence the most positive. Gielt relates that a man who had contracted the disease at Ulme returned to his home, a village in which the malady had not existed for many years, and the disease soon developed itself in the town. The dejections of the sick man were thrown on a manure heap; in a short time thereafter four persons were attainted with the disease, and a fifth had intestinal catarrh with tumefaction of the spleen. The dejections of these new cases were buried under another manure heap, which was opened after nine months. Two men were employed at this work, and one of the two contracted typhoid fever and died.” *

According to Greisinger, the development of typhoid fever depends upon the action of putrid exhalations, particularly such as come from filthy privy pits and from excretal matters undergoing putrefactive fermentation

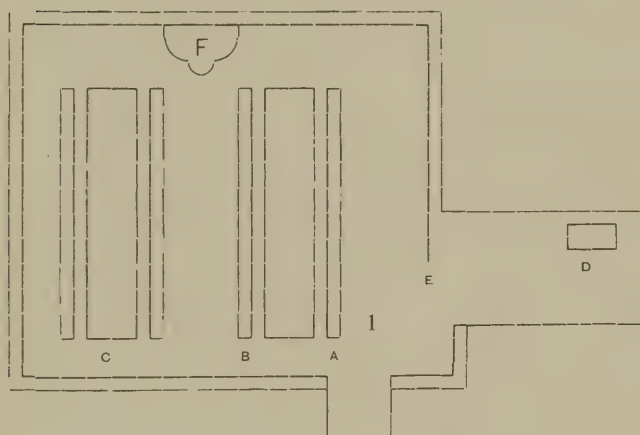
* Report of the International Medical Congress of Geneva, September, 1877.

in cesspools and sewers. These emanations he regards as "the active elements which play the essential role in epidemics of typhoid fever." *

Laver has communicated the following details of a serious endemic of typhoid fever which occurred in a boys' school attached to a charity institution:

"Of thirty-five pupils, twenty-eight contracted the malady. The first cases, and at the same time the most serious, occurred among the pupils who occupied the benches *a* and *b*, on the diagram, Fig. 7; and the very first case was that of the pupil who sat in the seat indicated by the number 1. The cases observed among the pupils who sat at the desk *c* were relatively mild."

FIG. 7.



"All the pupils slept in similar apartments, ate the same food, and, in all respects, were treated alike."

M. Laver was convinced that the fever was caused by emanations proceeding from an open inlet to the sewer, situated in the passage-way marked D. He says:

* *Traite des Maladies Infectieuses*, page 256.

"It will be noticed that the pupils seated on the benches marked *a* and *b*, who were the most seriously affected, were directly in the current of air which came from the sewer-inlet D, through the doorway E, and passed on to the fire F, which at that time was kept burning all day. Subsequently the opening into the sewer was closed, and the fever did not recur. There was no possibility of its having been introduced from without, and no case had existed previously in the institution. The pupils first attacked had been inmates of the house more than twelve months, and had not left the premises a single day during the time. The establishment was situated a little outside the town, but the sewer communicated with the houses of two or three rich families, in each of which there had been several cases of typhoid fever."

Murchison (*Treatise on Typhoid Fever*, 1878, page 73) relates the following circumstance:

"During the autumn of 1858 an epidemic of typhoid fever declared itself at Windsor, which was made the subject of special study by a medical commission. Four hundred and forty persons were attacked, and thirty-nine died. The opinion of all who were engaged in the investigation was that the fever was due to emanations from the sewers, which passed directly into the houses."

In M. Leon Colin's *Study of Typhoid Fever* (Paris, 1878, pp. 109 to 120), he recounts a number of epidemics of typhoid fever, the origin of which the army physicians ascribed to miasmatic emanations from latrines and cesspools located in the barracks or garrison. Many other illustrations might be cited wherein the outbreak of the disease has been traced directly to the poisoned air proceeding from sewers and excretal cesspools.

We should hesitate to pronounce as dangerous kitchen slops and other household waste waters, when recently formed, and free from putrescent matters or infectious germs; but Emerich has demonstrated that while such refuse liquids, when fresh, cause no injurious effects if injected into the circulation of animals, they will occasion disastrous effects if injected after they have remained several days and become decomposed. It not infrequently happens, moreover, that these foul waters

contain infectious germs, and the necessity of exercising great care with reference to them is not only important but urgent.

Another danger, less apparent but not less formidable, which arises from pollution of the soil by organic matters, is the vitiation of what is known as "ground air." This air, which occupies the interstices of the soil to a depth of several feet, is, especially in the winter, when the rooms are warmed, drawn into the apartments and forms part of the ventilation of the rooms, particularly those on the ground floor, which generally contain 10 or 15 per cent. of ground air. One can, therefore, readily understand and appreciate the importance, nay, the necessity of preserving the soil near dwelling houses in a pure and uncontaminated condition, for, as is the soil near a dwelling, so will be the air within.

CONCLUSIONS AS TO THE CAUSES OF INFECTION.

In an inquiry into a disease such as that prevailing at Cumberland, where the cases are distributed very generally over the town, there are four sources which are ordinarily looked to as those whence the infection is most likely to have proceeded, and by the medium of which it may have been distributed, viz: 1. A common source of water supply, such as some particular well or stream, or the mains of a system of public supply, in which case infection of the water, either at its source or in its progress, may result in the distribution with it of an infective material. 2. A common system of drainage, in which case a sewer becoming infected may be the means of distributing, through the means of the sewer air, infective air to the house or houses in relation with such sewer. 3. Where there is no common water supply and no common system of drainage to account for a wide distribution of fever, the cause of the spread may be found in the progressive infection of independent privies, &c., and by soakage from them into

independent wells or other supplies of drinking water; or (4) the cause of the spread may be found in the distribution over the district of some particular article of food, such as milk, which has become infected.

With a view to the full understanding of the present very difficult case, it will be well to consider the ordinary sources of infection severally.

I. There is no common system of drainage, and no cases of the disease having been traced to any particular milk supply those sources of infection may at once be eliminated from consideration.

II. The water supply of two-thirds of the houses invaded is derived from the city or river supply, and that of the remaining third from wells close to the houses, most of which are sunk into and gather their water from the water-bearing stratum underlying the town: and the water on this layer, which supplies all the wells, being undoubtedly infected, as has been shown by oft-repeated chemical analyses, could have caused the spread of the disease. I am not prepared to deny, indeed, there is strong reason to believe that in some instances this has actually happened; but we can by no means assign it as the main cause of the disease. With respect to the river water, it is a fact which has attracted attention, that a large proportion of the houses invaded, as above stated, derive their supply from this source alone, which is the common supply of the town; and this seems to have been the case in connection with each of the two apparently distinct outbreaks of the fever, namely, that apparently ending in July, 1890, and that apparently commencing in January, 1891. It is proper, therefore, to inquire whether an influence of this kind has been operative, and if found to have been operative, secondly, to what extent other circumstances operated in conjunction with it. That the river water, *per se*, was not the sole cause of the spread of the fever, is proved by the fact that, even assuming all the houses invaded to have drawn water from this source (which was not the case),

comparatively few of the whole number were attacked; while among those that were invaded there was something else in common and differentiating those houses from others that took water from the same source. To attribute the spread of the fever wholly to this cause would, under the peculiar circumstances of the case, be about as reasonable as to attribute it to the general atmosphere which the population breathed in common, and which no doubt bore its part as a factor in the spread of the disease, as will appear from the third feature of the infection.

III. Throughout the entire area of the town there are sanitary defects which might have had a part in spreading the fever, and most probably were to some degree operative in this way; these various sanitary defects have reference mainly to the mode of disposal of excrement and slops, and the relation of the mode of disposal of these matters to the atmosphere and wells of the city. Some of the larger residences in the city have water-closets which discharge into brick-walled cesspools, sometimes cemented, but in most cases laid with open joints or spaces. In the former case the contents of the cesspool are occasionally cleaned out and carried away; in other instances they overflow upon the surface and soak into the ground. In the latter case a direct soakage into the ground is constantly going on. The middle class and most business houses are provided with ordinary cesspit privies, usually so constructed as to permit of soakage of the contents into the ground. House slops are either at once thrown upon the ground, or being carried away by drains to a distance ultimately soak into the ground in like manner. In several instances the drains leading from the water-closets of good residences discharged directly on the surface of the ground, and in other instances are so badly constructed as to be leaky. Having regard to the fact that the ground intervening between cesspools, cesspits and leaky drains, and the wells and cisterns is always more or less perme-

able, the great liability of wells and cisterns to become polluted, by soakage of foul matter into the ground, must at once be obvious. In every instance where chemical analysis was made of the water of wells and springs in the town, the foulness of the water was such as to render its use for drinking or dietetic purposes absolutely dangerous. In only two instances was the water in cisterns found to be pure when subjected to chemical and bacteriological examinations. I refer here to the cistern in the court-house yard, and that at the residence of the Hon. Lloyd Lowndes. There is also a well at the Queen City Hotel, dignified by the name of an "artesian well," which is fairly free from organic matter, but far too heavily loaded with mineral matters in solution to be considered a good potable water.

While it is believed that the atmosphere and the wells of the city, polluted by foul emanations and soakage from filthy privies, have contributed no inconsiderable share towards the spread of the disease, there are against this explanation the following considerations:

(a) That the condition of things described as respects privies and well water has existed for many years prior to 1890; and although by importation or otherwise cases of fever had now and then occurred in the town, the disease had never before assumed an epidemic form, but cholera has on two occasions, in 1833 and 1854, invaded the community epidemically.*

(b) That in many instances the houses invaded (following the chronological order of their invasion) are situated at a long distance from one another, in some instances as much as half a mile; and only in a few instances had there been any communication between the inmates of invaded houses, and especially of such a kind as would lead to any probability of persons attacked

* This was long previous to the introduction of the river water supply.

with the disease having infected the atmosphere or the privies of any house subsequently invaded.

(c) That on the other hand, where there was inter-communication between the occupants of houses one of which had been invaded, and where, therefore, it was possible that the privies, and, secondarily, the atmosphere and well water of one house might have been infected by the occupant of another house, fever did not spread from one house to another.

(d) Lastly, apart from any question of infection of privies or water from some previous case, it is not a fact that the houses in any particular district, the arrangements of which in respect of the disposal of the excrement or sewage, or in respect of water pollution were faulty, were those solely or even principally invaded. A number of cases occurred in houses the sanitary arrangements of which, although not always unexceptionable, were far superior to those of houses occupied by a large part of the population who yet escaped the fever.

DETERIORATION OF THE RIVER WATER.

I would not labor unduly to frighten the citizens of Cumberland out of the use of that "poisonous fluid" called water; but, *prima facie*, there appears a strong probability that the prevalence of the fever has been in some way, and to some degree, associated with the city water supply as cause and effect. And this *prima facie* evidence turns out to be strengthened by the chemical and biological examinations made of the water, as will be seen by reference to the reports of Professors Tonry and Miller, respectively, wherein it is conclusively shown that, while the water at the intake from the river is not as pure as it could be desired, it is nevertheless much purer than that distributed in the mains, showing that the water in its progress from the intake at the river is in some way polluted with an infective material, which, it is believed, exists either in the

receiving cistern at the pump house or in the well immediately under the pumps, neither of which, it is stated, has been cleaned in a great many years—probably not since the inauguration of the system in 1873—and both of which have been subjected to pollution from various causes, increasing *pari passu* with the amount of water used, and which will continue to augment and become more virulent until proper measures of correction are applied. Again it is obvious, from the great waste of water, that the mains and service pipes are in a very defective and leaky condition, and it is possible, indeed *highly probable*, that they imbibe infective matter from the polluted soil in which they are imbedded.

But it is not alone to an accumulation of putrefactive matters in the receiving cistern and pump well, extending over nearly twenty years, that we must look for deterioration of the water supply. There is another source of dangerous pollution. It has been ascertained that there exists a continuous and free sipage of highly polluted water from the dam into the receiving cistern, which was intended as a clear water cistern, and also into the pump well. It is quite manifest, therefore, that the pumps, taking water from these receptacles and delivering it to houses in the city, are necessarily delivering a very impure if not absolutely dangerous water. The fact that water taken from the dam at this point is dangerously polluted was recognized by the city authorities more than a year ago, when an effort to correct the evil was made by removing the intake pipe several hundred yards higher up the river, above the sources of contamination; but it is now obvious that this very proper provision has corrected the evil only in degree, not in its entirety, for the inflow of contaminated water to the pumps still goes on to a very considerable extent, and the greater the volume of water in the dam the greater the inflow. Moreover, the stratum of earth through which this sipage takes place, and which formerly acted as a filtering medium, has no

doubt become filled with an abundant sediment of organic filth, which is imparted, in the form of low organisms, to every gallon of water that passes through it, and which is an offset to any advantage that may have been derived from the removal of the intake pipe.

The amount of water flowing daily into the clear water cistern and pump well, by sipage from a polluted source, is probably more than one-third of the entire amount which is daily supplied to the city; in other words, the supply going into the pumps is derived to a considerable extent from sipage water, which is known to be dangerously polluted. This is a matter that should claim special consideration on the part of the city authorities, for it is entirely practicable to overcome the evil by thoroughly cleaning and cementing the cistern and well, so as to exclude absolutely all sipage water. The water brought down through the intake pipe, though not at all times clear, is otherwise a good water, and as the quality of a water is the first consideration for health, the community should not be satisfied until the changes necessary to secure it have been effected.

If the city authorities, or those at least who have charge of the water service department, would look "at home" and see what time, and dirt, and neglect have been piling up in the receiving cistern, pump well and dead ends of mains for nearly twenty years, as well as the infiltration of polluted matter into the water through defective joints and broken pipes, the water of the Potomac would not so easily lose its reputation, nor the people their health. Peep into these sources of contamination, for here lies the worst part of the evil; here is the fault—here is the neglect—and here must a great portion at least of the remedy be supplied. Professor Tonry shows by his analysis that there is from 14 to 17 per cent. more of objectionable organic matter in the water that leaves the pumps than in that which enters the inlet pipe, and his tell-tale chemistry has been fully confirmed by the bacteriological examinations of Pro-

fessor Miller, who has reported 4,504 more bacteria in a cubic centimetre of water drawn from the spigot at the pump well than in the water drawn from the river at the inlet. These investigations have clearly demonstrated the following facts:

1. That the river water taken at the inlet pipe is reasonably pure.

2. That it is contaminated with infective matter in its progress for distribution.

3. That the most obvious sources of contamination exist in the receiving cistern, and notably so in the well from which the water is pumped into the city mains; and no doubt by sipage into the defective mains and service pipes.

These receptacles, viz., the receiving cistern and well at the pump house serve to deposit the mud and *floating* organic matters which the water must bring into them, and these matters become in time animalized, if such a term may be coined, and produce sickness among those who use the water. The inlet pipe may send the water as pure as possible, but it cannot remain so after mingling with the inflow of sipage water and passing through the two filthy receptacles above named, both of which must necessarily be highly polluted with obnoxious and dangerous matters.

I know not whether the city authorities can remedy the evils above pointed out, but it is clear, for their reputation as well as the health of the community, that they should if they can, because there is no doubt that these evils will from time to time continue to make themselves felt, in a depreciated condition of the public health. The whole method of water supply, especially the condition of affairs at the pump house, is bad—essentially bad, or badly devised. Here comes the muddy water from the river directly into the pumping house, where it mingles with polluted sipage water, and gathers up such putrefactive matters as exist in the cistern and well, and is then sent into the street mains to sup-

ply customers, instead of being pumped into a high service reservoir, where it could undergo subsidence and be afterwards filtered and delivered by gravity, in a reasonably pure condition to customers.

Although the Potomac water above Cumberland may not be as pure as that which comes from the clouds on St. Swithin's day, it is as pure as water taken from the river at any other place, and quite pure enough for domestic use, if properly protected and clarified. As far as can be ascertained, it contains, *per se*, nothing absolutely injurious, only a variable quantity of loam and clay in suspension, which can be readily eliminated by the simple process of subsidence and filtration.

At times it does not contain even that, and is purer than rain water after falling through the atmosphere of a large city. Of course, reference is here made to water taken from the river above the dam, and far enough up to escape the possible contingency of pollution from the inflow of the city drainage. This is an important question to be considered. No man in his senses would assuredly lay a water-pipe at the mouth of a sewer, or near enough to be affected thereby; but when laid at any point that common sense would choose, the river water will be good, even if it does receive some refuse from houses on the banks, provided always that the pollution is not in the nature of specific germs, which according to Koch and Flugge will not only live but multiply in the purest water. Dr. Bolton has shown (*Nouvelle Revue d'Hygiène*) that the bacilli of typhoid fever will live in pure water for thirty days, and three months in water containing one grain of organic matter per quart of water.

But in the water, as in the atmosphere, there is a regulation of nature (we cannot call it a law) for decomposing and precipitating animal and vegetable substances. It is not easy to discover chemically, or truly what the exact process or processes are by which this change is effected; but some of the general causes are

apparent. Let us note the common apparent causes: and first of these is bulk. The great disproportion of the pure water to the foul is the most obvious cause of purification. We might expect that this would only act by mere dilution, but it appears to do more, though it is not apparent how it does act chemically, further than through the dissolved oxygen contained in the water; the next apparent cause is motion, respecting the powers of which there is no doubt, and on the probable action of which it is more easy to speculate. If a pool of fresh, or salt water be at rest, and containing offensive matter, vegetable or animal, in solution, agitating it will in a great measure dissipate or precipitate the organic matter. And if quantity and motion be united, the effect is most rapid, as may be observed at sea after a prolonged calm. Now both quantity and motion are constantly operating on the water of the Potomac River, and thus it is purified every hour, every minute.

Again, the action of the atmosphere is largely concerned in the purification of water, by the exposure in succession of all parts of the water to the air. The volatile matter and gases become dissipated in the air, or decomposed by it as in other and commoner cases; but there is yet somewhat more accomplished, for some portion of the dissolved substances are thus rendered insoluble and are precipitated.

There is, moreover, another purifying cause, which singularly enough is one of the great grievances complained of. This is the mud of the river itself. I use the vulgar and prejudiced term "mud," because it will probably be better understood. Speaking chemically, I mean finely divided silica and alumina chiefly. This is a precipitant to the matters in solution, it combines with them, especially with the extractive matters and bacteria which corrupt and injure water, and carries them to the bottom, where their decomposition is afterwards completed, though not always very quickly, and we may, therefore, have pure water lying upon or flowing over

offensive mud. Thus the mud or clay of the Potomac, which renders it so disagreeable to the eye, is after all one of the causes of purification and purity. Muddy water is not nice, but it is at least innocent; and it is seldom very difficult to purify. The people of Cumberland may, therefore, console themselves with reflecting that the visible evil of mud in the water produces a balance of good, and is a trouble that can and should be remedied by filtration.

RECOMMENDATIONS.

FIRST. That measures be at once taken to provide an efficient board of health. This will involve, among other things, the employment of a trained and thoroughly competent sanitary officer. There is a large amount of sanitary work to be done in Cumberland, the details of which must be left, to a great extent, discretionary in order to secure the best results without burthensome expense; but this discretionary power should be intrusted only to a competent health authority, independent of politics, and unless it be provided, I do not think that any efforts to improve the sanitary condition of the city will be successful.

SECOND. That it is important there should be some change in the present system of water-supply (1) by discontinuing absolutely the use of water from pumps or wells, and also from polluted cisterns and springs; and (2) by filtering the present water-supply from the Potomac River, through some preparation of iron before it is distributed throughout the city; (3) by repairing, cementing, and keeping clean the receiving cistern, and pump well, and by making all mains and service pipes so absolutely tight that no pollution can enter them from the soil in which they are embedded.

Experiments have been made which appear to show that noxious microbes may be removed, or at least rendered harmless, by certain methods of filtration. At the

International Hygienic Congress which assembled in Paris in August, 1889, it was stated that guinea-pigs were inoculated with water containing the microbe of anthrax, and that those inoculated with the water prior to filtration died with the usual symptoms of the disease, while those inoculated with the same water after filtration survived. It was also stated that "a sufficiently careful filtration will remove most organic matters—*among others strychnia*;" and the scientist who made this discovery was so sure of his facts that he drank, after filtration, a quantity of water in which, before it was poured into the filter, a poisonous dose of strichnia had been poured. Be this as it may, there can be no doubt that the filtration of water through magnetic spongy carbon, which is a form of burt iron, will remove, according to Dr. Angell, 94 per cent. of the oxidizable organic matters in the water, and it is further stated by the same authority that the material is "quite impermeable to atmospheric germs."

THIRD. That impure ice is as dangerous as impure water, and ice for domestic use should never be gathered from a source where the water before freezing was unfit for drinking purposes. The germs of typhoid fever, and probably of other diseases may be imprisoned in ice, and after liberation, by melting, become active in the production of disease. These are facts well known in sanitary science, and they should be equally well understood by the people.

FOURTH. That all cesspools and privy vaults in the city should be thoroughly cleaned and disinfected, and hereafter no system of dealing with excrement should be permitted which involves pollution of soil, water or air. That in those portions of the city so thickly settled as to warrant it, there should be introduced a system of sewers upon a plan substantially as recommended by Mr. Gaffney, but to discharge the crude sewage into settling tanks instead of the river, to be treated with chemical precipitants, and subsequently to run off the

supernatant liquids on to an irrigation field, and treat the solids *secundem artem*.

FIFTH. That garbage should be kept separate from all inorganic matter, such as ashes, &c., and regularly removed by city carts to the country for use by farmers.

It is all important that this highly putrescible matter should be systematically removed from the city before fermentation takes place. Many cities in America, both large and small, are now trying the experiment of cremating the garbage, and the experiment has thus far been attended with very satisfactory results. Whatever system may be adopted for the removal of garbage, or excretal matters it should be under municipal control. The city should take charge of the removal of both excrement and garbage from all premises, and should insure by frequent and trustworthy inspection the cleanliness of all premises and the proper condition of the receptacles used for garbage.

SIXTH. That the natural drains or streams passing through the city, with a sufficient strip of ground on each side to insure their control and freedom from pollution, should be made the property of the city for securing drainage and as public walks, the banks being properly grassed and a constant stream of clear water being secured in each one.

SEVENTH. That certain houses in the city should be condemned, torn down, the materials removed, and the premises thoroughly cleaned and disinfected. This will include not only foul shanties and cabins, but some larger buildings in the heart of the city.

EIGHTH. That a system of building regulations should be enacted and enforced, providing that no building shall be hereafter erected in the city unless the plans have been approved by the City Board of Health, and that the construction shall also be subject to its inspection and approval. All uncondemned buildings whose lower floors are less than two feet from the ground should be raised to that height as early as possible, and in future all

dwellings should be built with their lower floors at least two feet from the ground; also that all cellars and basements should be freely ventilated. All this should be enforced by municipal authority.

NINTH. That the draft of the code of health laws submitted to the Council through Mayor McKaig, be substantially adopted for the sanitary government of the city. This code it may be here remarked prescribes how slaughter-houses, and other industrial nuisances shall be dealt with, and practically excludes pig pens from the city limits.

TENTH. That all streets and alleys be properly graded and paved, or McAdamized, on a properly prepared road-bed, with gutters and curbs made of cement or concrete.

ELEVENTH. That the health ordinances of the City be enforced *by the City Authorities*. It is quite impossible for the State Board of Health to exercise the functions of a municipal government, though it is at all times ready and willing to *aid* the local authorities in securing sanitary reforms.

TWELFTH. That politics be eliminated from the sanitary government of the City; and that all good citizens, without regard to party affiliations, unite in promoting the public welfare by insisting upon the enforcement of such measures of reform as will secure exemption from dirt, disorder and disease. *The health of the people should be the supreme law of the City.*

APPENDIX.

INSPECTORS' RETURNS.

The returns made by the Inspectors concerning the sanitary investigation of Cumberland show that 1603 house-to-house visitations were made—that 916 nuisances were reported, and that direct and positive data were obtained on 587 cases of typhoid fever which occurred within the corporate limits of Cumberland within the 18 months ending March 17th, 1891. Other cases of fever were mentioned to the Inspectors, but the removal of the families in which the cases occurred, and the unwillingness, in very many cases, of present occupants to know or remember what had occurred prevented the Inspectors from securing positive data as to such cases. This unwillingness to give information will be apparent by referring to the total deaths from typhoid reported by the Inspectors, viz., 52.

Deaths may occur in Cumberland from small-pox, typhoid fever, poison, or abortion, and the body may be quietly disposed of without the authorities having any cognizance of the case, and for the reason that no burial permit is required. The city keeps no record of deaths, and the death-rate in Cumberland at any time is an unknown quantity, the nearest approach to it that can be made being through the columns of the *Weekly Courier*, which paper collects its data from the undertakers.

Tabular statements of nuisances and of diseases reported by the State Board of Health Inspectors are given below:

NUISANCES REPORTED.

Privy vaults	in a state of nuisance.....	476
Wet cellars	" " " "	85
Water closets	" " " "	9
Privy in house	" " " "	1
Open cesspool	" " " "	1
Covered cesspools	" " " "	26
Manure piles	" " " "	41
Pig pens	" " " "	139
Cow stables	" " " "	8
Horse stables	" " " "	4
Slaughter-houses	" " " "	5
Hide houses	" " " "	4
Old wells used as receptacles of garbage.....		2
Sunken hogsheads used as receptacles of garbage.....		1
Piles of mixed garbage and ashes.....		2
Covered wells used as pig pens		1
Stables used as pig pens.....		1
Privies " " " "		2
Yards in a state of nuisance.....		47
Alleys " " " "		9
Parts of streets in a state of nuisance.....		3
Open lots " " " "		4
Drains " " " "		30
Dilapidated houses in a state of nuisance.....		9
Overcrowded " " " "		2
Unused cistern " " " "		1
Drain from privy, through yard, to run in front of house		1
Dead hogs in Race		2

 916

There were 158 cows found on premises visited. There were 468 pigs found on premises visited.

The number of pigs noticed on the streets, lanes, alleys and lots were not counted, as there were no marks by which they could be identified. Probably the total number in the city would not fall short of one thousand.

DISEASES REPORTED.

DISEASE.	RECOVERIES.	DEATHS.	TOTAL.
Typhoid Fever.....	535	52	587
Scarlet Fever.....	40	6	46
Diphtheria	13	5	18
Malaria	26	...	26
Consumption.....	...	3	3
Dysentery	5	...	5
Diarrhoea	3	...	3
Cholera Infantum.....	2	...	2
Chicken Pox.....	4	...	4
Capillary Bronchitis.....	...	1	1
Pneumonia.....	4	3	7
Erysipelas	1	1	2
Pleurisy	2	...	2
	635	71	706

Respectfully submitted,

C. W. CHANCELLOR, M. D.,

*Secretary and Executive Officer,
State Board of Health of Maryland.*

REPORT OF PROF. WM. P. TONRY ON THE
WATER SUPPLY OF CUMBERLAND.

BALTIMORE, April 3, 1891.

Dr. C. W. Chancellor, Secretary State Board of Health.

DEAR SIR:—The following report on the present condition of the water supply of Cumberland, Md., in connection with the sanitary investigation now under your charge, is respectfully submitted:

The water furnished by the municipality of Cumberland is known locally as the "Holly Water," on account of its being forced through the city by the Holly pumps and directly into the water mains. The water used is from the north branch of the Potomac River, taken within the city limits, and presumably from a point on the river bank about 1300 feet above the pumping house, which is also on the river bank and within 50 feet of the river. By natural flow, the water passes from the river into a brick well, a few feet from the river, thence by natural flow along the river's bank, through terra cotta pipe, for about 1300 feet, and then flows into a settling well, which is 20 feet deep and 28 feet in diameter. This well is just outside of the pump house and quite close to the river's bank. From the settling well the water flows into the well under the Holly pumps, and is then pumped directly into the street mains. The pressure on the street mains depends on the pressure maintained at the pump house, and should the pump stop the city water supply would stop. With the exception of the deposition, in the two wells mentioned, of the heavier particles of suspended solids that may be in the water, there is no attempt at purifying the water as it is received from the river, nor is it possible to clean out the two wells mentioned without stopping

the entire water supply that is furnished by the Holly system.

On March 13, 1891, I obtained for analysis four samples of the city (Holly) water. Sample I, from the Potomac River at the entrance to the receiving well; Sample II, from the receiving well; Sample III, from the settling well; Sample IV, from the pump-house spigot, just after the water had passed through the pumps. When these samples were obtained it was raining hard, and had been raining or snowing on the previous 6th, 9th and 12th days of the same month. The water in the river was high, and was flowing over the dam below the pump house. Sample V was obtained four days later, on the 17th of March, from the store of E. H. Welsh, 150 Baltimore street, a distance of about 2500 feet from the pump house. All the samples gave a solid deposit on settling, and this solid and suspended matter is not included in the report of analysis, as each sample was allowed to settle for at least five hours before the beginning of the analysis. In the analysis, the ammonia, free and albuminoid, is expressed in "parts per million," the other constituents in "grains per gallon."

	AMMONIA.		SOLIDS.				Character of the Sample.
	Free.	Album.	Vola- tile.	Mine- ral.	Total.	Chlorine.	
I.	.03	.07	4.00	4.20	8.20	.30	Suspicious.
II.	.07	.03	.....	.....	.....	.30	.....
III.	.05	.10	4.25	5.90	10.15	.50	Bad.
IV.	.02	.06	3.50	4.25	7.75	.35	Suspicious.
V.	.01	.08	4.10	4.20	8.30	.35	Suspicious.

Each of the above samples gives, by direct evaporation, a residue which blackened on burning, and the residue from III also deflagrated. Each one of the samples, without being evaporated or concentrated, gave with Nessler's solution a precipitate. Sample III immediate,

the other samples after a short time. These precipitates accompany this report. The amount of organic matter (volatile solids) dissolved in each of the samples is about double what may be expected in a good water, and is in such quantity and of such quality, as shown by the albuminoid ammonia, as will suffice for the support and propagation of germ life and bacteria. Sample II shows the change, by putrefactive fermentation, of the albuminoid ammonia into free ammonia. Sample III, from the settling well, just outside the pump house, shows infiltration from some source, more impure than the water of the Potomac at the point from which Sample I was taken; the solids, volatile and mineral are increased, the albuminoid ammonia is increased, and the chlorine is increased, and nitrates are present. It may be that this infiltration takes place along the line of the terra cotta pipes, but whether it does or does not, the infiltrating liquid has an intimate connection with privy well, stable yard or some such source in which chlorine and nitrates may be looked for.

Comparing the analysis of Sample III with Sample IV, it will be seen that all the water delivered by the pumps to the city mains does not come from the settling well alone, as it is received through the terra cotta pipe. That this so-called settling well is not impervious to drainage from the immediate surroundings would seem certain from the fact that on one occasion, when the supply from the terra cotta pipe had to be shut off, the infiltration into the well could not be kept down by the use of one of the Holly pumps in the pump house. Comparing the analysis of Sample V with Sample IV would seem to indicate that matter deposited in the street mains causes the water when it reaches the consumer at a distance from the pump house to be more impure than the river water at the point where it is supposed to enter for the city supply.

In addition to the river water, Cumberland has two other sources from which water is obtained for drinking

purposes, viz:—from cisterns in which rain water is collected and from wells sunk in the ground. It may be stated as a truth, verified in every locality where investigation had been made, that well water, drawn from the sub-strata of water, under a thickly populated locality, is unfit for use as a drinking water. I have found this true in Baltimore City in over 200 localities from which I examined the well water. I found this true in Frederick City in every well examined in the City during the prevalence of diphtheria there. I have found it true in every thickly populated section where I have examined the subsoil water. As to the source from which well water is obtained, and as to the impurities that find their way into well water, I quote here part of an article written by me for the Baltimore Sun and printed in that paper on November 2nd, 1888.

“That there is a subterranean sheet of water at different depths in different localities, would seem to need no other confirmation than the fact that water may be had in almost any locality simply by digging for it. The depth of this saturated subsoil or ground water will vary from a few feet to several hundred, depending very much on the position which the less porous rock or clay holds to the more porous soil above them. More than one stratum of ground water may and have been found in the same locality, but at different depths. The stratum of ground water is in constant movement towards the nearest water course, or towards the sea at the rate of five to fifteen feet per day, depending much on the character of ground which it traverses. It is from this ground water that our wells and springs receive their supply, while the ground water itself is furnished by the rain that percolates into the soil. It has been computed that about twenty-five per cent. of the rain that falls on sand rock will penetrate the rock, and about forty per cent. will percolate through chalk, while as much as ninety per cent. of a rain will find its way by percolation into a loose, sandy soil. With the solvent power which

water is known to possess, and which it does not loose when percolating through the soil, it can readily be inferred that waste products committed to the soil without other thought or care than to get rid of them are dissolved by the water in its passage through the soil, and find their way to the nearest bed of ground water, and may make their presence felt in the water drawn from every well that draws its supply from that particular water belt. It is generally said that a well will drain a surface the radius of which is equal to the depth of the well, and the statement is true as far as it goes, but it by no means states the whole truth. A little calculation of the amount of water drawn annually from a well in constant use, and another calculation of the annual rainfall around the mouth of the well in a circle whose radius shall be the depth of the well, will show that enough rain does not fall in the space indicated to supply the amount of water taken, or that can be taken from the well. It would be more correct to say that a well drains or draws its water-supply from the whole surface which furnishes the water-supply to the belt of ground water with which the well is connected. It may be said *a priori* that the water of all shallow wells, in the thickly inhabited portions of all cities, is impure."

Indeed in a locality like Cumberland, where so much of the surface of the city is unpaved, where excretal matter finds its way into the soil, and remains until the soil is saturated, every rain, as it percolates through the soil, but adds to the defilement of the subsoil water strata, from which sunken wells receive their water-supply.

The 70 feet well in the German Grave-Yard with 0.40 grains chlorine per gallon, is the best well water in Cumberland—but it is not a pure water. The Rolling Mill well water with 0.90 grains chlorine, is more objectionable, and more suspicious. The water from the well in front of St. Peter and Paul's Catholic Church, with 2.40 grains chlorine, is worse than the Rolling Mill well, and is a dangerous water for drinking purposes. The spring

in rear of 13 Kearney Street with 2.70 grains chlorine, is unfit for use as a drinking water, as also is the water from the well back of St. Patrick's Catholic Church, with 2.80 grains chlorine. The water from a recently bored artesian well 50 feet deep, at 65 William Street with 4.50 grains chlorine is unfit for use as a potable water—while the water of the 22 feet well at 17 Baker Street, with 7.50 grains chlorine per gallon would be pronounced filthy by chemical analysis alone, even if there had not been 9 cases of typhoid fever in the adjoining house—and even if the attending physician had not found it necessary to order the use of this water to be discontinued. The amount of organic filth in these samples of well water is made apparent to the eye, in the sample bottles which accompany this report.*

In an absolutely pure natural water, I have never found the chlorine to exceed 0.25 grains per gallon, while I have found it as low as 0.15 of a grain. Water from stable, barn, kitchen sink or privy well will be found rich in chlorine. Man and indeed all animals must have common salt, and chlorine one of the constituents of common salt, unless in very homeopathic doses in a water, points like a danger signal to the very objectionable organic impurities with which it is always found.

A third source from which, in Cumberland, water is obtained for drinking purposes, is from rain water, which after having been collected on the roof of the house, is stored in cisterns under ground. A sample of this kind of water, from the residence of Hon. Lloyd Lowndes showed only 0.20 grains chlorine—one from cistern in Court House yard showed 0.25 grains chlorine—as also did a sample from the cistern in Monastery of Capuchin Fathers on Fayette Street. Further chemical analysis of these samples gave such results as would cause them to be classed as good potable waters, while the sample

* These waters are so absolutely impure that a more detailed statement of analytical results is deemed unnecessary.

from the cemented cistern at 28 Washington Street, with 0.50 grains chlorine would have to be classed, at least, as suspicious. This last cistern is 10 feet deep and is said to be cemented within and without; but it is only about 15 or 20 feet from a deep privy well, and notwithstanding the cement, the analysis points directly to the privy well as the source of contamination. In populous locations, where the soil is saturated with decomposing and decomposable matter, it should be remembered that the gases resulting from decomposition, and accompanying germs find their way into the atmosphere where they may remain till brought to the earth again by falling rain. When, therefore, cistern water is used, it should not be forgotten that rain water from a polluted atmosphere will itself be polluted, and that unless purified by filtration through burnt or spongy iron, or by other means, it may be a dangerous vehicle for the propagation of disease. Although there are, at present, some cisterns in Cumberland that contain good water, yet an increase of soil pollution, or an increase of manufacturing establishments from which impurities may find their way into the atmosphere will make it dangerous to continue the use of rain water, however carefully it may be stored, for drinking purposes.

Analyses of samples of water taken by myself from Blue Spring, from Paine Spring, from Gramlich Spring, and from the Spring at the end of Haley's Alley, show that the waters of these springs are too impure to be recommended as potable waters.

In 297 locations, within the corporate limits of Cumberland, wherein occurred 440 cases of typhoid fever about which the State Board of Health Inspectors obtained direct and positive information,* there were 40 locations wherein occurred 62 cases, of which 7 were fatal, where the city water was not on the premises. There were 30 loca-

* A number of cases are known to have occurred of which no data could be obtained.

tions with 42 cases, 6 of which were fatal, where city water, as also spring, cistern or well water were on the premises. There were 227 locations with 336 cases, of which 28 were fatal, where the city water alone was on the premises. The following table gives these data more in detail:

WATER USED.	No. of Locations.	No. of Cases.	No. of Deaths.	WATER USED.	No. of Locations.	No. of Cases.	No. of Deaths.
Well	16	33	3	City and Well.....	11	18	3
Pump	8	9	2	" " Pump.....	1	1	.....
Cistern.....	6	6	1	" " Cistern ..	7	10	1
Spring.....	2	3	.....	" " Spring ...	10	12	2
Rain water from barrel	1	1	.....	" Well and Cis- tern	1	1	.....
Artesian Well.....	1	1	.....		30	42	6
Cistern and Arte- sian Well.....	1	1	.....			
Cistern and Pump..	1	1	.....			
Cistern and Spring.	1	1	.....	City Water alone..	227	336	28
Well and Spring. ..	1	4	.....			
Well and B. and O.	1	1	1				
B. and O.....	1	1	.....			
	40	62	7		257	378	34

Respectfully,

WM. P. TONRY, Ph. D.,

Analyst State Board of Health.

VACCINATION IN THE SCHOOLS OF CUMBERLAND REPORTED BY PROF. W. P. TONRY.

DR. C. W. CHANCELLOR,

Secretary State Board of Health.

Dear Sir:—As directed by you, I visited, on the 4th, 5th and 6th of March, 1891, the public and private schools of Cumberland, Md., for the purpose of ascertaining how far the law of this State had been complied with, which requires each pupil to be vaccinated before being admitted to any school. The accompanying tabular statement, gives in detail, for each school and each class, the result of my investigation.

As a resume, I find in the

Public Schools, 1295 pupils on roll, of whom there were present

446 boys, of whom 222 were not vaccinated..49.7 per cent.

421 girls, " 192 " " 45.6 per cent.

867 414 " " 47.7 per cent.

Denominational School, 652 on roll, of whom there were present

211 boys, of whom 134 were not vaccinated..63.5 per cent.

202 girls, " 111 " " 54.9 per cent.

413 " 245 " " 59.3 per cent.

Total on Roll, 1947, of whom 1280 were present, and of these 659 were not vaccinated, 51⁴⁸/₁₀₀ per cent.

In the two Public Schools for colored children (included in the above),

I find 120 on roll, of whom there were present

49 boys, and of these 38 were not vaccinated..77.5 per cent.

22 girls, " " 15 " " " 68.1 per cent.

71 53 " " " 74.6 per cent.

Respectfully,

WM. P. TONRY, Ph.D., M. D.,

Inspector State Board of Health.

REPORT ON VACCINATION.—Continued.

NAME OF SCHOOL.	NAME OF TEACHERS.	GRADE.	On Roll.		Not Vaccinated.	AGE OF THOSE PRESENT.		Date of Visit.	LOCATION OF SCHOOL.	REMARKS.
			Boy	Girl		Boy	Girls.			
Alleghany County Academy.	Mr. J. S. Crockett	.....	23	21	2	10 to 17	12 to 18	3, 6, '91	Washington St....	Mr. J. S. Crockett, Principal.
	Miss Georgie Houghton	.....	7	14	5	8 - 12	7 - 11			
	" Sue Thruston	..... Primary								
Alleghany County High School.	Miss Constance Salmon	..... High School (Gr.....)	30	39	26	24	2			
	" Maud Spencer	..... 6th.....	20	38	16	31	1	14 - 17		
	" Laura Young	..... 5th.....	25	29	19	23	3	12 - 16		
	" Ella Clarke	..... 4th.....	27	23	17	16	1	11 - 16		
	" Stella Macbeth	..... 4th.....	25	31	19	22	1	10 - 15		
	" Stella Wetnet	..... 3rd and 2nd.....	27	30	22	20	8	8 - 15		
	" Rebecca Sipes	..... Part of 2nd.....	22	29	12	22	3	9 - 13		
	" Jessie White	..... 2nd and 1st.....	31	28	20	23	11	8 - 13		
	" Mary Hilleary	..... 1st.....	36	28	23	12	20	7 - 12		
			31	39	17	18	17	6 - 9		
Centre St. School....	Miss B. A. Noone	..... 5th and 6th.....	244	275	165	187	65	60		
	" L. E. Taafel	..... 4th.....	20	23	14	19	2	5	12 - 16	
	" Lizzie Lingo	..... 4th.....	25	21	16	13	6	6	11 - 16	
	" Lizzie Leonard	..... 3rd.....	22	24	17	15	7	9	9 - 12	
	" Bessie Robt	..... 3rd.....	23	20	13	15	7	9	10 - 13	
	" Maggie Rowe	..... 2nd.....	30	22	24	13	14	6	8 - 12	
	" Clara Butler	..... 1st.....	27	25	16	17	14	17	7 - 9	
	" Ella Scott	..... 1st.....	31	17	21	13	15	10	7 - 11	
			23	28	19	21	14	20	6 - 9	
			201	180	140	126	73	82		
Maryland Avenue School.	Mr. J. E. J. Buckley	..... 6th, 5th and 4th.....	14	22	6	7	2	1	10 - 15	
	Miss Carrie Kephart	..... 3rd and 2nd.....	26	23	16	16	9	15	8 - 14	
	" Emma Everstettin	..... 1st.....	24	22	15	10	14	8	6 - 9	
			64	67	37	33	25	24		
Green St. School....	Miss Alice McMichael	..... 6th, 5th and 4th.....	15	14	13	13	4	1	8 - 16	
	" Marion Spear	..... 3rd, 2nd and 1st.....	18	28	16	16	9	10	6 - 11	
Mary Hove School....	Miss Mary W. Sims	.....	33	42	29	29	13	11	9 - 13	
	Mr. J. C. Johnson, (col'd.)	.....	25	16	18	6	10	2	9 - 14	
	Miss Mary W. Sims	.....	24	16	12	11	10	9	6 - 13	
Baptist School.....	Miss Alice B. Peyton	.....	49	32	30	17	20	11	12 - 14	
			25	14	19	5	18	4	6 - 15	
			25	14	19	5	18	4	8 - 15	
			646	649	446	421	222	192		

REPORT ON VACCINATION.—Continued.

NAME OF SCHOOL.	NAME OF TEACHERS.	GRADE.	On Roll.			Not Vaccinated.			AGE OF THOSE PRESENT.		Date of Visit.	LOCATION OF SCHOOL.	REMARKS.
			Boy (Hr)	Boy (Gr)	Boy (Hr)	Boy (Gr)	Boy (Hr)	Boy (Gr)	Boys.	Girls.			
St. Patrick's	Sister Blandina		42	22	15					9 to 13	3, 4, '91	North Centre St.	Father M. J. Brennan, Pastor.
	Michael		30	20	8					12 - 17			Catholic Schools attached to St. Patrick's Church.
	Chrysostom		45	16	13	11			5 to 12	5 - 13			
	Bernard		38	29	11				8 - 13				
	Cecelia		30	17	9				12 - 15				
St. Peter and Paul's	Sister Leonard		118	117	62	58	33	34			3, 4, '91	Payette Street	Father Felix, Pastor.
	Hyselath		60	42	33				9 - 14				Catholic Schools attached to St. Peter and Paul's Church.
	Ursula		35	45	32				7 - 12				
	DeChantel		37	32	16	16	16		6 - 9	5 - 9			
	Chart		54	26	15					7 - 15			
German English Lutheran School.	Rev. C. Wagner		65	54	26					10 14			
	Mrs. C. Wagner		152	151	103	96	80	57			3, 5, '91	Bedford St.	
			25	23	7				6 - 14				
			45	31	14								
			25	45	23	31	7	14					
Evangelical Lutheran Trinity Congregational School.	Rev. J. F. W. Kuhlman		24	20	23	17	14	6	8	14	7	15	
			24	20	23	17	14	6			3, 5, '91		
			319	333	211	202	134	111					
Resumé	Public Schools	White	572	603	397	399	184	177					
	"	Colored	74	46	49	22	38	15					
			646	649	446	421	222	192					
Catholic Schools		White	270	268	165	154	113	91					
		White	49	65	46	48	21	20					
			319	333	211	202	134	111					

REPORT OF C. O. MILLER, M. D.,
ON THE BIOLOGICAL EXAMINATION OF
WATER AT CUMBERLAND, MD.

BALTIMORE, *April* 29, 1891.

DR. C. W. CHANCELLOR,

Secretary State Board of Health.

Dear Sir:—The water for examination was collected by me in sterilized flasks from the following sources on March 12th and 14th:

1. From the river at entrance to pipe which conveys the water from the river to the receiving cistern at pump house.
2. From the receiving cistern at pump house.
3. From the spigot on the main going from the pumps to supply the city.

The water from each of these sources was decidedly cloudy, gave a very perceptible sediment on standing, gave no odor, and had suspended in it some brownish flakes. A bacteriological examination was made to determine the number of bacteria per cubic centimeter,* and to study the varieties of bacteria present with reference to the presence of typhoid bacillus.

Soon after the water was drawn, Agar-Agar Esmarch tubes were made in the usual way with aseptic precaution, the tubes were kept in a warm place, and as soon as the colonies developed they were counted; the number of colonies corresponding to the number of bacteria present in one cubic centimeter of water at the time that

* Four cubic centimeters are equal to 1.08 drachms, which is a teaspoonfull.

the cultures were made. A number of cultures were made from each source, and the following averages were obtained:

1. River water at entrance pipe, 1056 per cubic centimeter.

2. Receiving cistern at pump house, 3256 per cubic centimeter.

3. Spigot on the main going from the pumps to supply the city, 5554 per cubic centimeter.

We thus see that there is an increase in the number of bacteria, from the time that the water enters the pipe at the river, until it is distributed from the pumps for city consumption.

The increase can be accounted for in several ways, first, by a stagnation of the water and a multiplication of the bacteria which were present in the water when it left the river; secondly, contamination of the water in the pipes or the receiving cistern by the influx of contaminated surface or ground water, or thirdly, from an accumulation of filth in the bottom of the well under the engine, which would furnish a suitable nidus for the growth of bacteria.

The number of bacteria in the water supplied to the city is largely in excess of the number found in a potable water. Water which contain several hundred bacteria per cubic centimeter is considered in a general way as not being injurious; if the number exceeds 500 per cubic centimeter the source of the water-supply, and chances of contamination with sewage require a careful study. It is also necessary to take into consideration the number of different varieties of bacteria present. Among the great number of varieties which grow in water, there are usually a comparatively small number that are injurious to the human body. An attempt was made to discover the typhoid bacillus if it was present. Inasmuch as the typhoid bacillus resembles many other bacteria in its morphology and growth, it is difficult to pick it out from such a large number of varieties as were

present in the water. Several bacteria were found which had some resemblances to the typhoid bacillus, but I failed to find any that were identical with it in every respect.

The failure to find the typhoid bacillus in a given water supply at a given time, does not permit me to conclude that the water supply is free from suspicion.

The water was taken from the river at a time when there had been a good deal of rain for some weeks previously, and we can fairly conclude that the water of the river itself had more bacteria in it than usual. Dr. Theobald Smith found in the Potomac river water at Washington, that the number of bacteria were largest when there was the greatest turbidity and deposit in the water, and that this was most marked in the winter months.

Dr. Smith's* table giving the monthly average number of bacteria found in 1 c. c. of Potomac drinking water during 1886.

	No. observation.	Average.	Rain fall in in.
January	2	3774	3.46
February.....	4	2536	2.79
March	5	1210	4.16
April	4	1521	4.21
May	3	1069	8.77
June..	2	348	4.98
July..	2	255	8.42
August..	1	254	1.02
September... ..	2	128	1.04
October	3	75	1.04
November..	1	116	3.69
December.	2	967	3.07
January,	3	882	3.19

Dr. Smith says in reference to the relation between the rain fall and the number of bacteria in the water, that "the heaviest rains occurred in July, but the number of bacteria did not rise perceptibly and no turbidity ap-

* Medical News, April 9th, 1887, reprint in American Monthly Microscopical Journal, July, 1887.

peared. The precipitated water is caught by the foliage of the trees, by the grass and herbage which clothe the soil every where. The soil is at the same time more firmly bound together by the vegetation itself. In winter all this is changed. The absence of vegetation itself leaves the loose soil ready to be washed into streams by rain and melting snow, carrying with it the bacterial vegetation."

From a bacteriological examination alone the water of the river, as it enters the pipes, could not under the condition existing at the time the examination was made, be said to be particularly impure, but the water as supplied to the city, after having passed through the receiving cistern and pump well, contains by far too many bacteria to be classed as a potable water.

The sediment at the bottom of receiving cistern, and the water in the cistern were examined microscopically for other forms of life than bacteria. I found eight varieties of diatomes, but they were not very numerous. A few encysted forms belonging to the protozoa were found from which I was enabled to cultivate one variety of ciliata, one variety of amöba, and some flagellata. From our present knowledge, we are not in a position to attach much importance to the presence of these protozoa.

By the kindness of Dr. M. A. R. F. Carr, I was enabled to examine a case of the prevailing fever, and to obtain some of the fæces for bacteriological examination. The case was that of a girl $8\frac{1}{2}$ years of age in the 15th day of the disease; she was the fourth case that had occurred in that family during the past winter. She presented most of the characteristic symptoms and appearance of a case of typhoid fever. From the fæces I was enabled to isolate a bacillus, which when submitted to all the usual tests for establishing the identity of the typhoid bacillus, presented all the morphological characteristics, modes of growth and reactions as the typhoid bacillus.

I also examined the water from three cisterns, each of the samples were clear and colorless, and without any sediment except that No. I contained a few fragments of leaves. They contained the following numbers of bacteria per cubic centimeter:

No. I. Hon. Lloyd Lowndes' cistern, 120 per c. c.

No. II. Court House cistern, 116 per c. c.

Supplied drinking water for Mr. Milholland.

No. III. Gen. Sprague's cistern, 5204 per c. c.

Samples Nos. I and II are in marked contrast to the water from the city water works and cistern No. III.

The sanitary inspection of the surroundings of the cistern, together with the bacteriological examination, indicate that the water in Nos. I and II is good for drinking purposes. No. III is very much richer in bacteria than it should be, and the surroundings are such that the water should be condemned until the cistern is re-cemented, and the surroundings improved.

Respectfully submitted,

C. O. MILLER, M. D.

BALTIMORE, *May 3d*, 1891.

DR. C. W. CHANCELLOR,
Secretary, State Board of Health.

DEAR SIR:—The accompanying tracing is from a map of Cumberland, the use of which was kindly obtained for me by Mr. J. P. Gaffney, C. E., from the Electric Light Co., in Cumberland. Since the original map was made, there have been some changes in the lines of the streets in the Southern part of Cumberland, which changes are not noted on the map, and are not on the tracing. I have marked on the tracing 535 cases of recovery, and 52 cases of death from Typhoid Fever. These cases occurred within the corporate limits of Cumberland, between January 1st, 1890, and March 17th, 1891. Typhoid cases that occurred in the northeastern and in the southern portions of the city are not noted on the tracing. No other than Typhoid cases are noted on the tracing.

Respectfully,

WM. P. TONRY, Ph. D., M. D.,
Analyst and Inspector, S. B. H.

EXPLANATION OF MAP.

G—Springs.
S—Slaughter Houses.
T—Tanneries.
P—Soap Factories.
V—Old Grave Yards.
M—Cemeteries now in use.

CITY WATER WORKS:

I—Inlet and Upper Cistern.
T—Terra Cotta Pipe—1,300 ft.
N—Receiving Tank.
U—Pump House.

○—Typhoid cases—recoveries.
●—Typhoid cases—deaths.



